Paint the Town Green

Green Infrastructure for Tomorrow

A Plan for Open Space Reinvestment in Wisconsin's Communities

Acknowledgements

Open spaces and the natural systems they support are key to the future of Wisconsin's cities. To consider the future of open spaces, more than 150 individuals came together at a series of Forums in the fall of 2002. Sharing ideas and suggestions, they started the work on this plan for reinvestment in Wisconsin's "green infrastructure," the network of open spaces that make our communities livable. The Community Open Space Partnership (COSP) Steering Team provided leadership and direction for the creation of the GIFT (Green Infrastructure for Tomorrow) Plan. Anne Forbes (Partners in Place) masterfully facilitated preparation and implementation of the Forums.

While no portion of the plan is the product of any one person, several members of the COSP Steering Team served as editors/writers for one or more chapters or major segments, including:
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Executive Summary

The Future of Urban Areas

Open spaces and the natural systems they support are key to the future of Wisconsin's cities. The network of these spaces, or "green infrastructure," makes our cities livable. This is a plan for rethinking and reinvesting in Wisconsin's green infrastructure.

The Goals of COSP

The Community Open Space Partnership (COSP) is a broad-based coalition in Wisconsin dedicated to promoting the comprehensive network of open spaces in and around cities. COSP's strategies include regional coordination, public education, coalition development, and advocacy for statewide land use policy reform.

What Green Infrastructure Brings to Our Communities

An effective network of open spaces increases economic vitality, connects people to the natural world, promotes individual and community well-being and sustains natural systems. A strategically designed green infrastructure can retain and attract businesses, encourage new housing, increase the local tax base, provide venues for civic life, cultivate an environmental ethic among urban residents, help manage storm water, and increase the health of residents.

The GIFT Plan

At a series of Forums held across Wisconsin in the fall of 2002, participants inventoried current green infrastructure features and considered how to achieve future goals. They identified strategies at the local, regional and statewide level. From this, COSP has drafted this document: The Green Infrastructure for Tomorrow, A Plan for Open Space Reinvestment in Wisconsin (GIFT Plan). This plan describes COSP's vision for green infrastructure and outlines its legislative agenda.

GIFT Plan Objectives

- Strengthen green infrastructure policies at the local, state, and federal levels
- Increase public understanding of the ecological, social, and economic importance of green infrastructure and its potential to improve urban communities
- Develop support tools to help partners articulate and implement green infrastructure in their communities
- Encourage broad-based participation in land use reform and planning
- Foster innovative partnerships and effective strategies built on relationships that promote information sharing

Our Vision Grows from these Principles

The Community Open Space Partnership has adopted Principles as the core values of the partnership. They guide the work of the partnership and all those who seek to make open space a building block of stronger communities. We recognize *green infrastructure* as the network of open spaces in and around cities. This network, often including parks, forests, waterways, and wetlands, enhances economic vitality, sustains natural systems, connects people to the natural world, and increases individual and community well being.

Homes, workplaces, schools, and shops thrive side-by-side with community open spaces as they each serve the economic, environmental, social, recreational, cultural, and spiritual needs of the community. Open spaces support the economy by maintaining or increasing nearby home values and offering open-space-related business opportunities. They are key to significant environmental issues such as water quality, air quality, storm water, and wildlife habitat. They are meeting spots where citizens connect with each other in community groups and sporting activities, and where they can express and celebrate their cultural identity. They are zones of refuge and spiritual renewal for people and for other living things. They are truly special places in the community.

While we cherish and celebrate these special places, we recognize our responsibility to protect and nurture them as well. The principles of the Community Open Space Partnership are a set of guidelines for meeting those responsibilities. Not every open space (existing or imagined) will satisfy every principle. Rather, the principles are intended to serve as our source of inspiration and as a yardstick for measuring our success in creating high-- quality green infrastructure in communities across Wisconsin.

We are committed to open spaces that are:

Equally Available and Accessible. Every neighborhood has quality open spaces that are inviting and accommodating.

Safe. Open spaces are safe places.

Diverse. All community residents and visitors can access a variety of open spaces that support diverse uses.

Connected. A network of spaces enhances other public places and civic amenities.

Ecologically sound. Open spaces provide environmental benefits.

Engaging. Open spaces promote cultural understanding, interpret environmental and cultural identities, and foster community pride.

Cared for. Citizens care for open spaces and foster an appreciation of nature in their families and neighborhoods.

Funded. Communities sufficiently fund open space planning and management to meet citizen needs and community goals.

We are committed to processes that are:

Community-Driven. Open space planning and decision-making reflect community values, respond to citizens' needs, and address broader community goals.

Inclusive. Everyone is welcome in the open space planning and decision-making process.

Informed by science. Decision-makers use sound environmental science in open space planning and management.

Innovative. Communities achieve creative solutions through innovative partnerships.

Policy Agenda Overview

The Partnership seeks to foster land use development patterns that 1) honor natural systems supporting quality of life, 2) create a strong economy, and 3) engage the public in land use decision-making processes that respect the broad range of community opinions and objectives.

There are five broad areas targeted for action.

1. Build the capacity of communities to undertake and complete these green infrastructure projects.

2. Build broad commitment to the goals and objectives of green infrastructure.

3. Create effective strategies to implement the Vision.

4. Build momentum by demonstrating success and maximizing returns on investments.

5. Improve communications among those with an interest in the long-term health of Wisconsin's Cities.

Conclusion

We recognize that Wisconsin is a long way from achieving a seamless interconnected web of open space that winds through every neighborhood, connecting our rural countryside with the heart of our downtowns. We are not fully capitalizing on existing opportunities. To accomplish our vision will require ongoing collaboration and commitment from all segments of the community. We aim to inspire our fellow citizens while summarizing the opportunities in understandable language. Together with public and private sector partners, we aim to achieve the specific goals outlined in this report by developing win-win strategies that balance the diverse needs of our communities. This document will serve as a resource guide for policies, investment, and on-the-ground management.

We propose this GIFT plan of action to create a better Wisconsin for all.

Principles

Community Open Space Partnership

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We are committed to open spaces that are:

Equally Available and Accessible. Every neighborhood has quality open spaces that are inviting and accommodating.

Open spaces are located throughout a community so all residents and visitors have access to quality spaces nearby. Some open spaces meet local needs. Others meet regional needs. Both types of spaces need to be accessible. Open spaces can be used by multiple generations and differing cultures. Individuals of various physical and cognitive abilities can safely access open spaces.

Safe. Open spaces are safe places.

Open spaces are not only structured physically for safety, but are perceived as havens for everyone. They are not centers of criminal activity. People of all backgrounds and abilities feel comfortable getting to and enjoying these areas. Conflicts between uses are minimized.

Diverse. All community residents and visitors can access a variety of open spaces that support diverse uses.

Communities have open spaces of various sizes supporting a variety of uses and purposes to accommodate diverse user groups. Open space designs can be adapted to meet changing local and regional needs without diminishing the experience of a coherent and unified space.

Connected. A network of spaces enhances other public places and civic amenities.

Communities and regions have networks of open spaces. Interconnected spaces provide greater opportunities and more diverse experiences. Connected spaces enhance ecological diversity and functions. Open spaces are connected to public transportation and pedestrian facilities. Libraries, schools, courthouses, and other public facilities include open space.

Ecologically sound. Open spaces provide environmental benefits.

Open spaces address large-scale concerns. They provide habitat, minimize storm water runoff, infiltrate groundwater, and offer other environmental benefits. These are spaces where people can connect with nature.

Engaging. Open spaces promote cultural understanding, interpret environmental and cultural identities, and foster community pride.
Open spaces provide opportunities for multiple experiences. The design, materials, and uses reflect elements rooted in community values, history, and

cultural links. Open spaces help define a community as they positively affect the physical, emotional, cognitive, and spiritual growth of citizens.

Cared for. Citizens care for open spaces and foster an appreciation of nature in their families and neighborhoods. Communities demonstrate their caring in many ways as citizens of varied talents and interests devote time and resources to open space planning and management.

Funded. Communities sufficiently fund open space planning and management to meet citizen needs and community goals.

Open spaces, like highways and sewers, require investments to reap community benefits. The long-term success of open space also requires long-term commitment and maintenance to protect the quality of the environment and visitor enjoyment.

We are committed to processes that are:

Community-Driven. Open space planning and decision-making reflect community values, respond to citizens' needs, and address broader community goals.

Citizens create a vision to preserve and enhance open space. Communities address open space needs in relation to other goals, including local and regional economic priorities, social development objectives, and a local vision of community character. Citizens identify community assets, such as civic buildings, community organizations, and natural features that can be enhanced through strategic investments in open space.

Inclusive. Everyone is welcome in the open space planning and decision-making process.

Participation by community residents of all backgrounds and diverse interests drives the planning and design process. Traditional and non-traditional partners are sought out and included.

Informed by science. Decision-makers use sound scientific principles based on environmental evidence in open space planning and management.

The siting and design of open space consistently incorporates proven scientific principles regarding ecosystems and the connection between land and water resources. Planning for public open space recognizes that open space can function as a system if it is designed *with* nature, instead of *in spite of* nature. While managing and funding open space may continue to respect established political boundaries, planning for open space should address the regional ecosystem and watershed contexts.

Innovative. Communities achieve creative solutions through innovative partnerships.

Park professionals, community organizers, and public officials seek out creative partnerships and use collaborative processes to carry out visionary strategies for acquiring, funding, and managing open space.

A Green Way to Rebalance our Communities: Facing the Problems, Identifying the Opportunities

Our cities today face challenges ranging from loss of living-wage jobs to environmental contamination, from deteriorating roads and bridges to rising crime. From Milwaukee to Minong, Wisconsin's cities remain cultural and social centers where 80% of our state's residents reside. As they look for strategies to improve their economic, environmental, and social condition, more and more cities are turning to open space as a catalyst for community redevelopment. Today, *green infrastructure* represents the best opportunity for urban areas to reinvigorate local economies, address environmental problems, and promote a better quality of life for all citizens. Particularly in today's climate of tightening budgets and increasing demand for services, green infrastructure stands out as cities' most effective resource for attracting and retaining businesses, encouraging new housing, increasing local tax bases, managing storm water, providing venues for civic life, and cultivating an environmental ethic among urban residents. Green infrastructure *adds value* to our communities.

What is Green Infrastructure?
Green infrastructure is the network of connected open spaces in and around cities that is purposefully designed to:

- enhance economic vitality
- sustain natural systems
- increase individual and community well-being, and
- connect people to the natural world

Infrastructure traditionally has referred to the system of roads, sewers, and utilities necessary for the economic underpinnings and safety of a community. This planned, interconnected system, or "gray infrastructure," crosses jurisdictional boundaries to serve our everyday needs. Elements of the system require planning, design, and funding years before they are actually built. However, in our effort to "engineer" the landscape, we have frequently overlooked nature, altered it significantly, or destroyed it. Green infrastructure offers an alternative to entirely engineered solutions. Still, just like gray infrastructure, green infrastructure requires planning, designing, and funding.

What kinds of places are included in green infrastructure? Plazas, streetscapes, urban forests, bike lanes, vest pocket parks, community gardens, natural vegetation strips designed to filter parking lot run-off, and river systems with intact or restored floodplains, in addition to other common natural green spaces.

The Roots of Green Infrastructure
Early examples of green infrastructure in the United States include Fredrick Law Olmsted's "Emerald Necklace," an interconnected park system and greenway in Boston. In the Midwest, Olmsted, Daniel Burnham, Jens Jensen, H.W.S. Cleveland, Dwight Perkins, and others planned and designed park, forest preserve, and greenway systems for cities such as Chicago, Minneapolis, St. Louis, and Milwaukee. Daniel Burnham created his Chicago plan in 1909 and Charles Whitnal planned the extensive parkway system for Milwaukee in the 1920s. These early visionaries foresaw the need to identify and acquire open space in and near growing metropolitan regions. Their vision can inspire the citizens who continue their work today.

"If, therefore, the plan is a good one, its adoption and realization will produce for us conditions in which business enterprises can be carried on with the utmost economy, and with the certainty of successful issue, while we and our children can enjoy and improve life as we cannot now do. Then our own people will become home-keepers, and the stranger will seek our gates." --Daniel Burnham. The Chicago Plan 1909

A Contemporary Vision of Open Space

Green infrastructure planning is a modern-day version of the open space movement that began more than a century ago. The economic, social, and environmental issues in our cities today, however, do not mirror exactly those of the past. We must begin, therefore, by examining the health of our cities and surrounding areas. We need to rethink the plan and design of our communities in order to address economic and social issues such as urban blight, crime, and unemployment; and environmental issues such as storm water, flood control, water quality, and biodiversity. Just as good transportation and utility planning ignores jurisdictional boundaries, green infrastructure design should be regional in scope, bridging the urban core and the outlying undeveloped areas.

Roadblocks and Green Lights to Healthy Communities

Over many decades, civic leaders have made decisions one by one to address the challenges of the day, but collectively these decisions have created conditions that present a substantial barrier to our communities' long-term health and sustainability. Green infrastructure planning offers a different approach. (The discussion here is just the beginning; additional discussion, analysis, and input are required to broaden the examination of these and other issues that directly affect our cities).

Our engineered solutions have limited capacity and lifespan. Engineers design structures and mechanisms for dealing with specific problems. They necessarily rely on projections of development, demographics, and other factors in order to build for the future. Projections can be wrong, however, and, even when they're right, conditions often change over time. So engineered solutions have finite life spans. **Green infrastructure solutions, however, work on nature's time scale,** cost less to maintain, and provide other benefits, including wildlife habitat and recreational space.

Our communities are designed around vehicles, impeding alternative modes of transportation. Most urban environments in the U. S. are designed around vehicles instead of pedestrians, affecting the function and character of these spaces. Building more and larger highways promotes sprawl, leading to multiple environmental, social, and economic problems. **Pedestrian- and bike friendly design can provide a refreshing alternative** as well as new economic opportunities in our cities.

Our landscape is becoming homogenous. Communities lose their regional and local character as the same design practices, standards, and even restaurant chains come into communities across the country. The trend toward homogenization is pervasive, not only in the architecture of strip malls and subdivisions but also in our parks, campuses, and streetscapes, many of which are planted without species native to the region. Designers use exotic species readily available from the nursery industry. **Each community has a character based in its own natural amenities.** Design review commissions can safeguard that character by curtailing uninspired planning and design ideas; they can also ensure that green infrastructure is a fundamental part of all development and community planning initiatives. Nature offers a powerful model of successful systems and aesthetics and is best viewed as an inspiration for design rather than an obstacle to overcome, control, or replace with novelty.

Planning is disconnected. Open space and civic space planning have become project-specific, resulting in narrowly defined efforts scattered across a community rather than integrated throughout it. **Regional and city planning departments can encourage holistic green infrastructure planning**

and can look beyond jurisdictional boundaries to coordinate with neighboring communities on projects that offer mutual benefit.

Development occurs on inappropriate lands. When wetlands, floodplains, and other critical open spaces and natural areas are built upon, the community pays a heavy price, including increased flooding and reduced natural water filtration. **Communities need to map and protect all primary and secondary environmental corridors as well as wetlands, natural areas, floodplains, and critical habitat areas.** At the same time, communities need to identify areas that *are* suitable for development, recognizing that development must occur somewhere.

For every 1% increase in protected wetlands along a stream corridor, peak stream flows decrease by 3.7% --Illinois State Water Survey, 1993

Construction practices have detrimental effects on the natural landscape. The construction process often severely damages existing natural resources such as vegetation and wetland areas on a site. **Local ordinances could reduce or prevent these effects.** Some developers have taken positive steps to preserve and enhance the existing natural resources on development sites as part of a new process known as Low Impact Development or Conservation Development. Cities, villages, and towns should modify existing ordinances to encourage this new approach.

Funding for open space is insufficient. We seldom cut budgets for planning, developing, and maintaining "gray infrastructure." However, we frequently view funding for parks and open spaces as non-essential. Such funding is routinely among the early cuts in lean budget years. **Because of the positive effect of green infrastructure on the economic, social, and environmental health of communities, its funding must be considered a necessary component of fiscal budgets**, as line items for traditional infrastructure currently are. We must be committed to this funding over the long-term.

Public involvement in community decision-making is insufficient. Without public concern, involvement, and scrutiny, market-driven forces will shape community planning with priorities other than the optimum use of natural features. **An active and involved public is fundamental to the success of a green infrastructure initiative.**

Transforming Urban Communities

Communities that plan for their green infrastructure will be better positioned for economic stability. They will attract and retain businesses, encourage new housing, and increase their tax base, They will also offer diverse, locally-based open-space amenities in all neighborhoods. People will socialize in green places that lift their spirits, travel by foot or bike on interconnected trails throughout the region, and experience nature within their city.

The benefits of green infrastructure will be further articulated in Section 2.

We must preserve the best work of past generations and take bold steps to realize the full potential of our communities in the 21st Century. These bold steps require a new generation ready to meet the challenges facing our communities today. Americans are ready for the challenge, as evidenced by the increasing number of local and state ballot referenda promoting open space protection. In 2002, 141 land conservation measures passed (75%), triggering more than $5.7 billion in state and local funding. Such investment of public money shows that voters are coming to understand that natural systems are an essential asset, not a frill. We will continue to fundamentally transform our thinking about planning and redevelopment so that green infrastructure can transform our community life.

"We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect." Aldo Leopold, A Sand County Almanac

The Bridges of Green Infrastructure: Connecting Ecological, Economic, Health, and Social/ Cultural Benefits

As we begin to develop a coherent and connected system of green infrastructure in Wisconsin's built environments, our communities profit in a complex and interlocking series of relationships that bridge seemingly separate disciplines and concerns. Research continues to document the important role that open space can play in improving the overall quality of urban life. As we learn the potential significance of urban green infrastructure, we also become aware of a variety of intersecting benefits. No matter what the initial concern, the process of developing green infrastructure can have cascading positive impact: not only on human health, but on the vitality of our economies, the health of the environment, and on our social and cultural interactions. These issues overlap and can be positively addressed by our recommended focus of creating networks of green infrastructure and open spaces.

Beginning with ecology, we first take a more detailed look at how green infrastructure promotes biological diversity, manages storm water, and cleans the air. These three ecological benefits, in turn, provide the underlying structure that improves local economies and revitalizes the health of its citizens and communities.

"The development and expansion of urban life has delivered tremendous benefits and created significant new challenges. On the one hand, the modern city is a truly remarkable place: culturally, ethnically and religiously diverse, exploding with creative energy, rich in commodities and entertainment opportunities, dynamos of economic activity. Clearly, urban living has been a boon for many, affording greater comfort, convenience and intellectual stimulation.

On the other hand, the modern age has witnessed a severing of the spiritual, emotional and even physical connections between humans and the natural world. Living in the "built environment" of cities, we become oblivious to our ultimate dependence on, and responsibility for, the "unbuilt" world—the life-sustaining systems that make cities possible. Furthermore, as the sense of intimacy and shared investment typical of town and village life is lost, many people begin to feel isolated within an undifferentiated mass—paradoxically alone in the midst of the crowd. We have not done a sufficient job at meeting our "higher" needs for social connectivity, recreation, aesthetics, sense of place, neighborhood, and nature."

Urban Open Space Foundation Values Statement Summer, 2003

Bridge #1: The Link between Ecological Functions

The many ecological functions performed by green infrastructure are connected and interrelated. A given open space may provide habitat, clean the water, *and* clean the air. While discussed separately here, these functions are thoroughly linked in the real world, even as their benefits extend into the other arenas as well.

Green infrastructure supports habitat and protects species diversity.

Open spaces, and especially natural open spaces, help preserve biological diversity. A combination of behavioral adaptability and successful reproductive strategies has enabled some plants and animals to abound in human-dominated areas.[1] Urban natural areas provide some of the only remaining habitat for other species. For example, bird watchers have observed more than half of the 408 bird species documented in Wisconsin[2] in Milwaukee County alone. One hundred eighteen bird species are confirmed to nest in that county, and of these, 16 are listed as endangered, threatened, or special concern. More than 150 other bird species pass through the county during spring and autumn migrations.[3] This high level of diversity results directly from the availability of habitat scattered throughout the

county's parks, parkways, plazas, and other open spaces. Similarly, Appleton's Strobe Island, La Crosse's Oak Grove Cemetery and Hixon Forest, Stevens Point's Schmeeckle Reserve, UW-Madison's Arboretum, and the Kenosha and Racine harbors are popular urban birding spots because of the diverse habitat they support.[4]

The protection of biological diversity is a function of habitat size (the amount of available open space) and habitat configuration (the arrangement and connectivity of habitat parcels). A variety of habitats (forests, wetlands, grasslands, etc.) provides food, shelter, and space that enable many plant and animal species to live and reproduce in urban areas. A number of holdings in the urban environment may collectively form critical habitats. The optimal configuration of habitat can differ widely for different wildlife species, but an intricate system of tracts and corridors throughout an urban area often provides habitats and the means for wildlife to move through the urban system. With such systems, white-tailed deer and other animals manage to survive throughout many urban communities.[5] Even small patches of natural area make an important habitat contribution. Patches of woods located on streams, rivers, and ridges are heavily used by migrant birds as stopovers for foraging and resting during long flights to the tropics.[6] Milwaukee's lakefront parks, for example, have long been known as places to observe uncommon visiting water birds.

Wetlands, including those in urban areas, support many plants and animals. Thirty-nine percent of Wisconsin's birds live in or use wetlands.[7] La Crosse's Myrick Marsh and Green Bay's Bayport (Atkinson's) Marsh are just two examples of urban wetlands well known for supporting diverse bird populations.[8] One Wisconsin biologist identified southern lowland forests as "exceptionally rich" and aquatic communities, like open water marshes, as "extremely rich" in amphibians and reptiles, as compared to other community types in Wisconsin.[9] Even isolated urban wetlands provide homes for these small creatures. For example, the pond at Appleton's North High School, the grounds of Monona'a Aldo Leopold Nature Center, and the Urban Ecology Center in Milwaukee's Riverside Park are all good places to hear frogs calling.[10] Many native fish species require wetlands in some phase of their reproductive cycle. Preservation of urban wetlands help maintain popular sport fishing on heavily used urban lakes. For example, the wetland complex in Middleton's Pheasant Branch Conservancy provides spawning areas for northern pike that swim upstream from Lake Mendota. The stream that meanders through the Conservancy's marsh provides a home for a diverse fishery, including bowfin, largemouth bass, and several species of panfish.[11] Similarly, the last remaining wetlands along Marinette's Menominee River shoreline provide spawning areas for walleye and northern pike that are harvested from Green Bay waters.

Forested areas also host many mammals and migratory birds. Deciduous forests of mixed oak and sugar maple/mixed hardwoods are some of the most botanically diverse forests and the ones with the most animal species.[12] These forests with their layered structure[13] provide niches for birds on the forest floor –for example, the ovenbird; in the shrub layer, the wood thrush; and in the canopy or overstory, the scarlet tanager. The larger the contiguous forest area, the greater the density of individual animals and birds and the greater the species richness. The number of animals and the number of species are partly a product of forest structure and partly of habitat size.

Many of these urban habitats exist in complex relationships. Even subtle changes (like a relatively small reduction in tree cover) can cause a ripple effect through the food chain or in adjacent habitats, and can starkly reveal the benefits of open space after it is gone. Wisconsin biologists have found that relatively small amounts of urban land use in a watershed (as little as 10-20%) can lead to major changes in stream fisheries.[14,15] This research also suggests that urban development that minimizes the amount of connected impervious surface

and establishes undeveloped buffer areas along streams–characteristics of sound green infrastructure planning– will have less impact than conventional types of development.[16] Thoughtful habitat management for particular wildlife species may require an approach encompassing the entire urban system with an understanding of its relation to surrounding areas.[17]

Green infrastructure protects water resources and helps manage storm water.
In addition to providing habitat for animals, green infrastructure plays an important role in managing storm water and reducing the pollution it carries into rivers and streams. Urban communities throughout Wisconsin often face the problem of too much storm water and not enough places to put it. The expansion of impervious surfaces like roads, parking lots, driveways, and buildings results in flooding and heavy flows of storm water runoff into streams, wetlands, and lakes. Runoff from municipal areas contains a mixture of pollutants including heavy metals, pesticides, sediment, nutrients, bacteria, and oxygen-demanding organic wastes. Although municipal storm sewer systems can be efficient at conveying water to help avoid local flooding, they also transport this polluted runoff directly into nearby receiving waters without the benefit of wastewater treatment. Nationwide, urban storm water runoff ranks as the second most common source of water pollution for lakes and the third most common source for rivers.[18] In Wisconsin, poorly conceived urban land use is one of the primary causes of water pollution.[19]

Maintaining green spaces, planting trees, and reducing impervious surfaces---characteristics of mindful green infrastructure planning and management–can reduce local flooding, soil erosion, and thermal and chemical pollution of receiving waters. Vegetation-- like street and yard trees-- intercepts, slows, filters, and absorbs storm water. Vegetation draws moisture from the ground, thereby increasing soil water storage potential. Leaves, branch surfaces, and trunk bark intercept and store rainfall, thereby reducing runoff volumes and delaying the onset of peak flows. Root growth and decomposition increase the capacity of soils to infiltrate rainfall and reduce overland flows. The tree canopy reduces soil erosion by diminishing the impact of raindrops on barren or exposed soil.

Wetlands also help buffer and control the effects of storm water, by holding the water, slowing it down, and releasing it slowly. Storm water periodically recharges the wetlands. Such water storage is essential for wildlife dependent on wetlands for breeding success. However, when impervious cover in a watershed becomes too high a percentage of the total area, these natural functions of wetlands do not operate as well. If we think of wetlands as giant sponges, we can easily understand how the capacity of a wetland to perform its functions can be impaired by too frequent swamping, instead of periodic recharging. Carefully planned and managed green infrastructure properties help mitigate these problems.

Filtration of pollutants is a major ecological benefit of open space. Under natural conditions, rainfall is absorbed by vegetation and by soil, where many

contaminants are filtered out through the natural percolation process in the soil, returning cleaner water to groundwater sources.

Many of the water quality problems we face can be related back to the increase in non-point pollution, or runoff. Runoff occurs when precipitation falls on impervious surfaces such as roads, parking lots, and rooftops. Water cannot percolate through the soil. Instead, it flows quickly into storm drains and then into streams, rivers, and lakes. A one-acre parking lot produces sixteen times more runoff than a 1-acre meadow. No pollutants are filtered out of the water flowing off the parking lot. Additional pollutants are picked up by the water as it flows across roads and other surfaces.

Green infrastructure cleans the air, reduces greenhouse gases, and cools the community. Green infrastructure, particularly the urban forest, plays an important role in maintaining and enhancing local air quality. Trees remove gaseous and particulate pollutants from the air—pollutants that can affect human health, damage vegetation, and shorten the life of manmade materials, like concrete and steel. One U.S. Forest Service scientist found that trees in the city of Chicago removed 17 tons of carbon monoxide, 93 tons of sulfur dioxide, 98 tons of nitrogen dioxide, 210 tons of ozone, and 234 tons of particulate matter in one year.[20] Other Forest Service Scientists, working on the West Coast, found that pollutant uptake rates decreased with decreasing tree canopy cover along a rural-to-urban gradient, underscoring the importance of green infrastructure to the maintenance of urban air quality.[21] Urban land uses with the highest rates of pollutant uptake included residential areas, institutions (e.g., university campuses), and vacant, unmanaged, or natural areas, places that also have a high potential for additional tree planting and green infrastructure management.

Summer temperatures in cities are typically 2-8 degrees higher than in nearby forested areas—a phenomenon known as the urban heat island effect. Trees and other vegetation help moderate this heat by providing shade and releasing water vapor. As water evaporates from tree canopies, it consumes solar energy. Trees also shade paved surfaces and rooftops that would otherwise absorb and store heat energy.

While we might think of shade solely in terms of human comfort, shade also addresses important air quality issues. Parked cars are a major source—as much as 16%—of volatile organic compounds (VOCs), key contributors to smog. By shading cars parked along streets and in parking lots, trees reduce emissions caused by the evaporation and volatilization of fuel from gas tanks, and reduce other VOCs from hosing and vinyl parts.[22] In addition, ultraviolet radiation breaks down asphalt. Urban trees can extend the useful life of streets and parking lots by shading them.

Atmospheric carbon dioxide has increased by slightly more than one part per million per year over the last 50 to 60 years. This is significant because carbon dioxide and other "greenhouse" gases in the atmosphere are thought by many scientists to contribute to global warming. By absorbing carbon dioxide from the air during photosynthesis, trees and other vegetation directly reduce one of the primary gases associated with global warming. The carbon dioxide is stored in the plants' biomass as they grow over time.

This ecological result carries significant economic benefits. For example, in heavily treed Shorewood (with 39% tree cover), trees store 119 tons of carbon dioxide per hectare.[23] In addition, when trees are sited properly—shading west walls and air conditioning units—air conditioners run less and run more efficiently. With less air conditioner use, fossil fuel burning power plants that supply energy to run the air conditioners emit less carbon dioxide. U.S. Forest Service scientists found that urban trees were responsible for annual air conditioning savings of 12% in one West Coast county. That savings in energy consumption results in a net

Dane County Municipalities Working Together on Storm Water

Several communities in Dane County joined forces in 2002 to combat storm water runoff, the single largest source of pollution to the area's lakes, rivers, and streams.

Participating Communities:

City of Fitchburg
City of Madison
City of Middleton
City of Monona
City of Sun Prairie
City of Verona
Dane County
University of Wisconsin
Village of DeForest
Village of Maple Bluff
Village of McFarland
Village of Shorewood Hills
Village of Waunakee
Town of Burke
Town of Blooming Grove
Town of Madison
Town of Middleton
Town of Westport
Town of Windsor

The agreement outlines ways that the partners will collaborate to inform and educate the public about urban storm water pollution and prevention issues in central Dane County. Urban storm water is the largest pollutant in Dane County's lakes and rivers. The signed agreement was submitted to the Wisconsin Department of Natural Resources as part of the municipalities' storm water discharge permit applications. The agreement provides for a half-time storm water educator, housed in the County Land Conservation Department, for the 5-year permit period. Efforts funded in part by a grant from the Department of Natural Resources include a survey to determine public's knowledge of storm water issues, a media campaign, a utility bill insert, brochures, and a school outreach campaign.[25]

City of Middleton's Lakeview Park

The City of Middleton (Dane County) developed an "ecological assessment and restoration plan" for its 60-acre Lakeview Park. The main goals of the plan include 1) establishing plant and animal communities found in the area before European settlement; 2) preserving the diversity of plants, thus creating habitats for resident and migratory animals; 3) establishing plant communities that are more favorable for walking, cross-country skiing, and bird-watching; and 4) re-routing, capturing, and retaining storm water in wetland communities that filter, buffer, and clean this water before it enters Lake Mendota. The plan describes the park's past and current conditions and recommends restoration activities for 39 acres of conservancy area, including restoring an oak woodland and black ash swamp, sedge meadow, and button bush depression wetland communities.[26,27]

Milwaukee Metropolitan Sewerage District's Green Roof

Milwaukee's Metropolitan Sewerage District (MMSD) recently undertook a green roof project at its 4-story headquarters building, located just south of downtown Milwaukee. MMSD installed 435 containers holding a man-made growing material and dry prairie plant species that are native to the region. The containers cover about one-third of the building's 11,000-square-foot roof. A walkway built of recycled materials also is part of the green roof.

While green roofs serve various purposes, MMSD's project is mainly designed to demonstrate how much rainwater and polluted runoff you can keep out of the sewer system and the rivers. Other benefits of green roofs include reduced energy costs, aesthetics, and reduced urban temperatures. The $69,360 green roof project is part of MMSD's Best Management Practices initiative, which looks at various methods to reduce or delay the volumes of storm water that can overwhelm the sewer system during periods of heavy rain and contribute to sewer overflows. More common in European countries, green roofs offer an innovative solution to stormwater management and at the same time improve energy performance of buildings and the urban ecology – without taking up any additional land.

Each container on MMSD's roof holds plants that will grow to 12-16 inches tall. Plants growing on dry bluffs along the Mississippi River in southwestern Wisconsin served as a natural model. Plantings indigenous to Wisconsin were selected for their ability to withstand summer's hot and dry conditions, as well as seasonal variations, that are typical of roof installations.[28]

annual economic savings of $20 million and a reduction in peak energy-use that saves an additional $6 million by avoiding cooling costs.[24]

Bridge #2: The Connection between Ecological and Economic Benefits

Communities that carefully plan and maintain green infrastructure are improving their quality of life while helping their bottom lines as well. Proponents of preserving open space have to persuade local officials that the benefits of not developing the land for homes and businesses are greater than converting land to developed uses—subdivisions and shopping centers. Development proposals are scrutinized for their impact on the bottom line.

Green infrastructure offers sound solutions to flood prevention and maintaining water and air quality. These solutions, derived from natural systems, are often cheaper, longer lasting and more efficient than engineered solutions. That makes them a cost effective way to provide a community

service, benefiting the community's economy. Green infrastructure makes economic sense in other ways. Healthy aquatic systems are indispensable for recreation, fishing, and tourism, critically important industries in many Wisconsin communities. Green infrastructure often means greater property values, creating a sustainable tax base, and generating higher property tax revenue for communities. Clean air and water resources also mean less illness for citizens and their greater contribution to the community. Here's a more detailed examination of the economic value of green infrastructure, including both revenue enhancements and cost savings.

"Open space possesses natural system value when it provides direct benefits to human society through such processes as ground water storage, climate moderation, flood control, storm damage prevention, and air and water pollution abatement. It is possible to assign a monetary value to such benefits by calculating the cost of the damages that would result if the benefits were not provided, or if public expenditures were required to build infrastructure to replace the functions of natural systems." [29]

Green infrastructure solutions cost less.
Green infrastructure provides cost effective alternatives to costly "gray infrastructure" approaches to storm water, flooding, and water and air quality problems. Storm water and flooding are among the most prevalent environmental challenges of urban communities. According to the US Army Corps of Engineers, the cost of flood damage averages $4.3 billion each year. Development has resulted in increased amounts of impervious surfaces, including roads, parking lots, and rooftops, that are unable to absorb water. As a result, we've developed engineered "gray infrastructure" systems to direct runoff into storage facilities, and ultimately into lakes, rivers, and streams. These engineered solutions are costly to design, build, and maintain, and typically cannot keep up with increasing demand.

Protected uplands are better able to retain precipitation, resulting in reduced flash flooding in nearby streams. Protected floodplains and wetlands act as natural "safety valves" for flooding, absorbing plugs of water and reducing the impacts of precipitation events on developed areas further downstream. By not building on these areas critical to water retention, we can minimize property damage costs from flooding.

The Milwaukee Metropolitan Sewerage District (MMSD) is implementing the Conservation Plan to purchase land in the watersheds in which MMSD has the responsibility to control flooding. MMSD has proposed or implemented flood control projects costing $300 million. Antonio Riley, head of the Commission governing MMSD until 2003, explained the Conservation Plan as an effort to protect the district's investment in flood control projects. "If we don't do anything to preserve the natural areas along the waterways, we will be back to having residents' homes flooded in 20 years and will have wasted the money that is being spent today on important flood management projects."[30] MMSD has budgeted $15 million to acquire land to soak up and hold rains before they reach waterways and, with the assistance of The Conservation Fund, has identified 7,065 acres that could provide 4.7 billion gallons of flood storage.

The plan is being implemented, in part, through an innovative effort called Greenseams. Teaming with the River Revitalization Foundation and the Wisconsin Department of Natural Resources, the MMSD Greenseams program recently purchased a conservation easement on nearly four and a half acres along the Milwaukee River. The easement connects two Milwaukee County-owned parcels along the western shore of the river between Gordon Park and North Avenue and will provide a naturally vegetated shoreline and a corridor for wildlife.

By combining resources, the Greenseams partners can take on larger projects and make greater strides toward accomplishing Greenseams goals than they would without this cooperation. Wisconsin Stewardship Grant funds were used in this agreement. The purchase price for the conservation easement was $150,000. The easement will preclude development of the land, yet allow MMSD access for flood management projects and other improvements to the natural shoreline. Future Greenseams efforts will increase recreational opportunities throughout the region.[31,32]

Water quality is another problem facing urban communities for which engineered "gray infrastructure" solutions are costly. Lakes, rivers, and streams are polluted by so called "non point source pollution," runoff that contains myriad pollutants from our lawns, roads, and parking lots. They also can be polluted more directly as a result of both

current and historic dumping of contaminants. Today, 36 million Americans drink water from sources that violate EPA contaminant standards. The agency has estimated that $140 billion would be needed over the next 20 years to make drinking water safe.

How might conscious use of green infrastructure address the issue of water quality cost effectively? New York City has elected to avoid building a new filtration plant by instead purchasing lands to protect its upstate watershed. They have researched and demonstrated the cost-effectiveness of this decision. The city is protecting 80,000 upland acres in the watershed that provide the city's drinking water, spending $1.5 billion for the acquisition. Had the watershed been developed, they would have been required to spend $8 billion building the filtration plant and an additional $300 million per year to run the plant.[33]

Air pollution in urban areas is a serious and growing problem. Burning fossil fuels has introduced a steady flow of deadly pollutants into our atmosphere. Today, few urban areas meet national clean air standards. Green infrastructure—which includes urban forests—presents an opportunity to improve urban air quality while providing aesthetic and other benefits at the same time. Urban forests remove nitrogen dioxide, sulfur dioxide, ozone, carbon monoxide, and small particulate matter.

Trees are proven to dramatically cut down urban air pollution. The tree canopy in Mecklenburg County, North Carolina, where the city of Charlotte is located, comprises 53% of the county's land area. This urban forest removes 17.5 million pounds of pollutants from the air each year, a benefit American Forests estimates is worth $43.8 million each year. Unfortunately, Mecklenburg County lost more than 22% of its tree cover between 1984 and 2001, a trend that is seen across the nation.[34]

Green infrastructure attracts business and increases sales.

Today's businesses, no longer tied to traditional industrial centers, are free to shop for a location that provides their employees with a high quality of life, a factor that is becoming a primary reason a company will choose a location for its business. Communities that want to attract new businesses and retain existing businesses need to invest in well-maintained green infrastructure—including parks, trails, and open space—to maintain economic vitality. Economic development offices and local chambers of commerce need to consider the role of green infrastructure in creating the quality-of-life factors that will draw new businesses and employees. They also need to market these amenities. Although the effect of open space on business development and sales has not been quantified as carefully as the impact on residential property values, we know the impact is real and significant.

Today's businesses also look for locations with a pool of knowledgeable and talented workers. These workers want to live in places with a high quality of life, "places with a diverse range of outdoor recreational activities, from walking trails to rock climbing… A survey of 1,200 high technology workers in 1998 by KPMG found that quality of life in a community increases the attractiveness of a job by 33 percent."[35]

Tourism associated with green infrastructure can also improve a community's economy. Quality parks and open spaces contribute to the attractiveness of cities as magnets for tourism, although the magnitude of this impact still needs to be quantified. Tourism related to fishing, hunting, birding, and water sports all benefit from ecological biodiversity, protected watersheds, and clean air connected with the ecological benefits of green infrastructure.

In metropolitan Green Bay, the Fox River Trail has had a substantial positive effect on businesses.[36] Surveys of 33 businesses found that 12 business owners believed the trail had a positive or very positive effect on their business. Restaurants and convenience stores were more likely than other kinds of businesses to benefit, "but managers of an antiques shop and a sporting goods store also believed their businesses benefited from the trail." Since the study was completed in November 2001, two bicycle stores have opened along the trail and many more businesses are mentioning the trail in their advertisements to increase sales to trail users.

Green infrastructure increases property values. Many studies have demonstrated that the closer a residential property is to parks and open space, the higher the real estate market value, with open space creating a sustainable tax base. The increase in property value generates a private benefit to the owners that is recouped when they sell their property. In addition, because local governments collect taxes based on the value of property, increased property values generate increased local government revenue.

In general the closer a home is to an open space, the higher the property value. Studies find that the impact extends at least a quarter mile from a park.[37] The size of the increase in property value depends on the characteristics of the open space (city parks, recreational trails, naturalized open space, etc.) and the characteristics of the neighborhoods surrounding these public spaces. Parks with major recreation activities (baseball, swimming, league soccer, etc.) generally had smaller incremental increases in value than did parks with passive uses (walking, picnicking, etc.). One author suggests a 20 percent increase in property values for homes abutting or facing a passive park is a reasonable rule of thumb, making open space key to a sustainable tax base.

Here in Wisconsin, a 2002 study analyzed the relationship between total assessed value of residential properties and proximity to parks for two parks, one in the Village of Jackson supporting "active" recreation, and the other in Germantown supporting primarily "passive" recreation (e.g., hiking, bird watching, picnicking).[38] The study found that, for both types of parks, the impact of the park on property values was positive and increased the closer the property was to the park. The total aggregate assessed value for all residential properties within 1000 feet of the active recreation park was $1.5 million higher than it would have been without the park, generating approximately $30,000 in property tax revenue for the municipality because of the park. For the "passive" recreation park, this amount was $879,000, yielding $18,000 in tax revenue annually.

Opinions of property owners and of real estate professionals reflect this value of open space. Studies show that property owners believe the value of their homes increases because of proximity to parks and open space. [39] In a 1987 study in Washington state, real estate agents estimated that properties near but not adjacent to the Burke-Gilman trail would sell for an average 6 percent more than other properties. In Minnesota, appraisers and real estate agents "claimed that trails were a positive selling point for suburban residential property, hobby farms, farmland proposed for development, and some types of small town commercial property."[40] Real estate agents near the Brush Creek Trail in Santa Rosa, California, believed that being near the trail would positively affect how quickly and for how much a home would sell. 41 About 19 percent said that homes on the trail would sell for slightly more; 61 percent said they use proximity to the trail as a selling point for the homes.

In Wisconsin, real estate agents who have listed properties along or near the Fox River Trail, which opened in 2001, have stated that the trail is a unique amenity that improves salability of homes and adds to property value. Most of the advertisements for these properties identify the Fox River Trail as an amenity. One agent suggested that the trail adds at least $5,000 to the property value. 42

With few exceptions, the findings of studies exploring the relationship between property values and open space lead to the conclusion that open space increases property values from 5 to 20 percent. Open space contributes to value by improving the quality of a home's view and improving the residents' access to outdoor recreation and nature. This property value increase benefits both homeowners, who benefit from public investment in open space through increases in the value of their homes, and local government, which benefits because higher home values mean larger property tax revenues. A variety of open space amenities make increases to the tax base a sustainable proposition.

Green infrastructure is cheaper to service than is residential development. A common strategy for municipalities looking to increase revenues is to spur development. More than

two decades of research on the costs of community services demonstrate that residential development usually does not generate enough tax revenue to cover the costs associated with serving an increased number of residents! The cost of schools tops the list, but police and fire services, parks, libraries, and other community facilities are also required to add staff, space (and cost!) as the local population increases.

In more than 70 studies, American Farmland Trust (AFT) has found that the cost of residential development exceeds the revenues raised from the increased tax base, supporting the concept that open space amenities mean increases to the tax base are sustainable in comparison to typical residential development. For every dollar of tax revenue generated from residential development in the 70 communities studied, service costs were $1.16. A "cost of community services" study conducted by AFT in Dunn Township, Wisconsin found the cost of services to residential development in that township to be $1.06 for every dollar of revenue generated from residential development. In Perry, Wisconsin, this amount was $1.20 per dollar of revenue, and in Westport, Wisconsin, it was $1.11 per dollar of revenue.[43] Another study found that, for a group of Wisconsin cities, residential development cost $1.01 for every dollar of revenue.[44]

In contrast to the costs associated with residential development, AFT found that "raw" (e.g. undeveloped) open space costs only about thirty-five cents to service for every dollar of revenue generated from such land. The caveat to such data, however, is that it may be less accurate in the urban context. First, in urban settings government units or non-profit organizations tend to own open space, rather than private individuals, as is frequently the case in rural areas. As a result, in urban areas, open space may generate no direct tax revenue (only the indirect revenue discussed in the last section), whereas privately held open space in rural areas may generate tax revenue (albeit at a lower rate than if the open space were developed). Second, urban open space may be more costly to serve, requiring more intensive maintenance and security than rural open space. Even so, urban open space will often entail less cost than residential land, making it an integral component of a sustainable tax base.

In the typical case described by AFT studies:
$1 revenue - $1.16 in service costs = $0.16 in costs to the local government

For green infrastructure land, the comparison is:
$0 revenue – *X* in service costs = *X* in costs to local government.

As long as $X < \$0.16$ per dollar of revenue for residential development that otherwise would have occurred on the site, the green infrastructure costs less than residential development. To complete the analysis, the costs (*X*) also need to be compared to other benefits of open space preservation, such as water and air quality, wildlife habitat, flooding control, etc., *as well as* other secondary economic benefits (citizens' health, increased business) accrued to the city as a result of green infrastructure.

In sum, the fiscal impacts of diverting land from being developed for homes and preserving open space is important in creating a sustainable tax base likely to yield a net benefit *except for* (1) communities with excess capacity to provide community services and (2) specialized parks, such as zoos and botanical

gardens that entail substantial development of facilities and/or maintenance costs.

Green infrastructure improves human health, which in turn improves the economic bottom line.
Communities spend millions on health care each year for people with diseases and illnesses that could be remedied by increased physical exercise and improved air and water quality. Green infrastructure can provide trails and parks in which residents can engage in physical activity for recreation or as part of their daily commute. Improvements in air quality accomplished through green infrastructure can improve cardiovascular health, reducing the incidence of asthma and other respiratory health problems. In addition, healthy people are better able to work and contribute to a healthy economy.

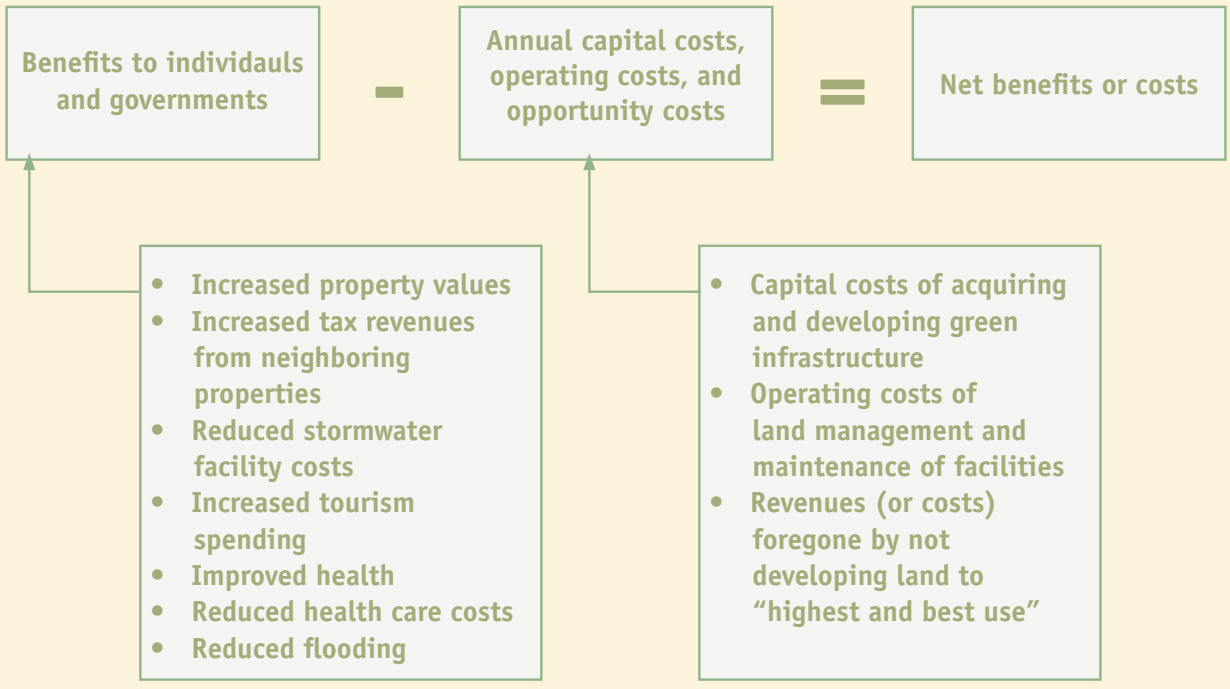
"Chronic diseases account for 7 of every 10 U.S. deaths and for more than 60% of medical care expenditures. In addition, the prolonged illness and disability associated with many chronic diseases decrease the quality of life for millions of Americans…. The estimated annual cost of obesity and overweight in the United States is about $117 billion." [45]

Bridge #3: From Human Health and Vitality as an Economic Plus to Health as an Overall Goal

Obviously, peoples' health and vitality means far more than an economic advantage. The health of our citizens is in many ways the fundamental goal of a community. Not only by improving air and water quality, but by providing physical spaces for exercise and recreation, green infrastructure can help remedy many of the health problems facing our citizens today, including obesity, asthma, and heart disease. It can also help with psychological health, alleviating depression and promoting healing. Here is a more detailed look at the relation between health and green infrastructure.

Green infrastructure promotes physical activity
Obesity is a growing problem in America. More than 60% of adults—59 million people—are overweight

Calculating the Net Cost/Benefit of Green Infrastructure



or obese; 13% percent of kids and 15% of teens—9 million young people—are overweight. Obesity contributes to 300,000 deaths a year in the U.S., costing an estimated $117 billion per year to the U.S. economy. [46]

Regular physical activity is one of the best things we can do not only to combat obesity but to improve our health overall. Regular physical activity reduces long-term risks for disability and premature death. It reduces the risk of dying of coronary heart disease, the nation's leading cause of death, and decreases the risks of colon cancer, diabetes, and high blood pressure, to name a few of the health benefits associated with moderate physical activity, such as 30 minutes of brisk walking five times a week.[47]

Despite the many health benefits of physical activity, more than 60% of American adults don't get enough physical activity to reap the benefits. Twenty-five percent of American adults are completely inactive. Kids are also inactive, much more so than in the past: fewer than 10% of kids ride or walk to school now whereas in the early 1970s more than 60% walked or biked to school.[48]

Since the 1950s the infrastructure to support walking and bicycling in the United States has been neglected. [49] Communities are not planned to provide easy access to regular physical activity. In some cases sidewalks aren't even built to accommodate pedestrians. In other cases, schools, shopping areas, and entertainment venues are located far from homes, necessitating car travel. Another reason for decreased physical activity is lack of time. We work more now than ever. In 1990, Americans worked an average of nearly one month more per year than in 1970.[50]

Green infrastructure can help address America's need for physical activity in a number of ways. Trails, parks, and well-designed pedestrian facilities, all part of an effective green infrastructure system, can encourage physical activity. By providing safe and attractive routes to work, school, places of worship, and shopping, green infrastructure can make it possible for people to combine exercise with necessary trips. Instead of driving to the gym to work out, urban Americans should be able to get physical activity as part of everyday life. Green infrastructure can also provide welcoming spaces for recreation and play.

Green infrastructure improves respiratory health. Air pollution is making Americans sick—literally. Lung disease, which includes respiratory tract infections, asthma, and lung cancer, claims nearly 335,000 lives in America each year and is the third-leading cause of death in the United States.[51] Four pollutants that have been associated with asthma were identified by the 1970 Clean Air Act as "criteria" pollutants requiring monitoring: sulfur dioxide, nitrogen oxides, ozone, and particulate matter. Over the last decade, the death rate for lung disease has risen faster than that of any of the top five causes of death." [52]

Asthma is the second most prevalent chronic condition among children, and is more common in urban areas. A study of New York inner-city children in the 1980s showed that these children were twice as likely to have asthma as the rest of the general US population. [53] In Chicago, the rate was found to be three times that of the general US population in a study conducted in the 1980s. [54] Researchers estimate that asthma cases will double by 2020, affecting 29 million Americans. [55]

Green infrastructure can help to improve air quality. As noted above, trees and other vegetation absorb carbon dioxide as part of photosynthesis, releasing the oxygen we breathe as a byproduct. An 80-foot beech tree has been shown to remove daily carbon dioxide amounts equivalent to that produced by two single-family dwellings.[56] Trees can absorb other chemicals that contribute to smog and the greenhouse effect. Particulate matter is trapped and filtered by leaves, stems and twigs, and is later washed to the

National Programs/Initiatives that promote physical activity:

• Active Living by Design (http://www.activelivingbydesign.org/)
Active Living by Design is a national program of The Robert Wood Johnson Foundation and is a part of the University of North Carolina, School of Public Health in Chapel Hill, North Carolina. The program will establish and evaluate innovative approaches to increase physical activity through community design, public policies, and communications strategies.

• Kids Walk-to-School Program (http://www.cdc.gov/nccdphp/dnpa/kidswalk/fact_sheet.htm)
The Centers for Disease Control and Prevention's (CDC) Kids Walk-to-School Program encourages children to walk to and from school in groups accompanied by adults. Walking to school helps children be more physically active, practice safe pedestrian skills, and learn about their environment.

• Shape up America! (http://www.shapeup.org)
Shape Up America! is a national initiative to promote healthy weight and increased physical activity in America. Involving a broad-based coalition of industry, medical/health, nutrition, physical fitness, and related organizations and experts, Shape Up America! is working to 1) promote a new understanding by Americans of the health importance of achieving and maintaining a healthy weight and increasing physical activity; 2) inform Americans of the logical, proven ways to achieve a healthy body weight; and 3) increase cooperation among national and community organizations committed to advancing healthy weight and increased physical activity as major public health priorities.

• World Health Day (http://www.cdc.gov/nccdphp/dnpa/worldhealth/index.htm)
April 7th of each year is designated as World Health Day and celebrated by the 191 member countries of the World Health Organization to emphasize significant issues in public health of worldwide concern.

• National Trails Day (http://www.americanhiking.org/events/ntd)
American Hiking Society's signature trail awareness program, National Trails Day, inspires over one million trail enthusiasts to flock to their favorite trails to discover, learn about,and celebrate trails. At over 3,000 events nationwide, trail clubs, retailers, federal agencies, municipal parks, land trusts, and businesses come together the first Saturday of each June to celebrate trails, recognize volunteers, and maintain local trails.

• National Bike Month (http://www.bikemonth.com)
National Bike Month™ provides an opportunity for friends of bicycling and the League of American Bicyclists to sponsor educational programs, bicycle commuting events, trail work days, bicycle helmet promotions, and even bicycle film festivals to draw positive attention to bicycling.

• American Trails, Inc. (http://www.americantrails.org)
American Trails' members are working to enhance and protect America's network of interconnected trails. They support local, regional, and long-distance trails and greenways, whether in backcountry, rural or urban areas. Their goal is to support America's trails by finding common ground and promoting cooperation among all trail interests.

• Rails-to-Trails Conservancy (http://www.railtrails.org)
The purpose of Rails-to-Trails Conservancy (RTC) is to enrich America's communities and countryside by creating a nationwide network of public trails from former rail lines and connecting corridors.

ground by precipitation. Trees also help to shade and cool our cities in the summertime, which can lessen the production of ozone and lower the demand for air conditioning, which in turn can result in lower emissions from power plants working to meet power demands.[57] Strategically planted trees can result in a 10-50% savings in cooling expenses, reducing the need to use carbon-based fuels, therefore reducing emissions that cause air pollution.[58]

Green infrastructure reduces waterborne illness and other water-related health problems.
We use water every day for drinking, irrigation, fishing, and recreation. The pollutants in these waters can have disturbing consequences for human health. The National Wildlife Foundation has documented that learning impairment and hyperactivity in children, lowered sperm count in men, immune system disorders, and cancer have been associated with toxic chemicals. Increased breast cancer rates in women and prostate and testicular cancer in men have been associated with certain chemical hormones that are found in our water. Humans are at risk when they drink water and eat fish, or when they are exposed to contaminated water through swimming.[59] Water pollution can also cause serious waterborne illness. In Wisconsin, more than 100 people died and 400,000 were sickened in 1993 from an intestinal virus linked to contaminated water that came from farmland runoff where livestock grazed.[60]

During heavy rains, storm water runoff from roofs, parking lots, roads and other non-porous surfaces speeds into storm drains, collecting pollutants as it flows. From there, it proceeds into our streams, rivers and lakes. More than 50 percent of waterborne disease outbreaks between 1948 and 1994 were preceded by extreme rainfall events.[61]

Green infrastructure can improve water quality by increasing the amount of porous natural system surfaces in our cities. Strategically placed wetlands and other open spaces can help slow the flow of storm water, increase infiltration into groundwater, and improve filtration of pollutants, resulting in long-term improvement in the health of local residents.

Green infrastructure helps alleviate mental fatigue, reduces conflict and violence and promotes healing.
"Seeing green prevents people from being mean." Or so say researchers from the University of Illinois at Urbana-Champaign who have been studying the relationships between people and the environments

they inhabit.[62] Their work and that of others shows that common urban conditions (including crowding, high temperatures, and noise) are associated with violent behavior, which is thought to be associated with "chronic mental fatigue." People with chronic mental fatigue can become irritable, impulsive, and inattentive, behaviors that have been linked to aggressive behavior. But the work of the researchers at the University of Illinois at Urbana-Champaign shows that exposure to green spaces can "mitigate the harmful effects of chronic mental fatigue, reducing aggressive behavior in the process."[63] Greenery also promotes a greater sense of community—even in poorer, inner-city neighborhoods—leading residents to feel safer and treat each other with greater civility.[64]

Vegetation also improves patient recovery. "Studies… have consistently shown that simply looking at environments dominated by greenery, flowers, or water—as compared to built scenes lacking nature (rooms, buildings, towns)—is significantly more effective in promoting recovery or restoration from stress." (See Ulrich, 1999, for a survey of studies.)[65]

Green infrastructure offers other potential benefits to keep humans healthy.
Increased shade from more extensive urban forests as part of our green infrastructure can reduce heat-related illnesses and deaths prevalent in cities that experience the heat-island effect. Green infrastructure can reduce the number of deaths and injuries that result from flooding by reducing flood risks. Connected green infrastructure networks can increase pedestrian and bicyclist safety through improved urban design, offering safe places for walking and bicycling. Furthermore, human health is directly

dependent on the biodiversity in open spaces since upwards of 25 percent of the compounds used in the pharmaceutical industry are found in nature.

Bridge #4: From Ecological, Economic, and Individual Health Grow Vibrant Social and Cultural Communities

Two of the processes fundamental to the Community Open Space Project are "inclusive" and "community driven." These two concepts manifest green infrastructure's underlying benefits for creating a vibrant community.

Healthy people living in healthy environments are happier, work harder, and enjoy an overall higher quality of life. They contribute more to the economy; they also contribute to the social and cultural landscape of a community. Green infrastructure planning provides an opportunity for neighbors to get involved, speak out, contribute to the decision-making process, then take on active responsibilities and ongoing roles in maintaining their unique communities.

Involvement in social activities frequently adds to the well being of the individual, who, in turn gives back more to the community. It's a virtuous cycle. Here's a more detailed look at how green infrastructure increases social and cultural balance, allowing people to meet, connect, and interact. These are spaces that encourage social interactions, vital cultural activities and an energized and involved community.

Green infrastructure lets people meet people or just relax.
Residents living closer to green spaces enjoy more social activities, have more visitors, know more of their neighbors, and have a stronger sense of belonging.[66] Activities in green spaces facilitate the development and maintenance of stronger social ties.[67] "Urban Parks and plazas reduce stress, act as a social facilitator, and encourage community cohesion."[68]

Community benefits result in *individual* benefits, which lead back to more community benefits. For example, where strong ties exist among residents, each resident is likely to feel more cared for and more accepted as member of that community. Residents who feel they "belong" and who have a higher self esteem are more likely to develop healthy relationships with others. This loop has the potential to magnify the benefits felt by both individuals and the community at large, further increasing the impact of green infrastructure on the health of cities.

Gordon Park in Milwaukee is located in Riverwest, a racially, ethnically, and socio-economically diverse neighborhood. After significant reinvestment by the county parks department, this park has become the focal point of community Independence Day celebrations and other community events. Neighbors come out in full force on these occasions, filling the park, interacting and developing social and community ties.

Dynamic open spaces provide a retreat from the strain of urban life. The scope of the natural world can make our problems seem less important. Research suggests that "we seek not only an opportunity to be contemplative, but to restore ourselves…. Landscapes should encourage a sense of calm or balance; a sense of escape that allows distraction from problems; a sense of perspective

or self-awareness that permits one to see their own problems as less threatening or debilitating; the opportunity to work the problems through; and an opportunity for reflection."[69,70] Nature provides a kind of "cognitive quiet" necessitating fewer decisions based on external demands.

Voted "Best place to restore tranquility during lunchtime," Waterfall Park in Seattle's historic Pioneer Square offers visitors a peaceful, shady spot that literally shuts out the hustle and bustle of the city. The cascading waters of the park's 22-foot high waterfall disguise the sound of nearby traffic, and lush vegetation provides visual relief.

Green infrastructure helps people stay active.
Ideally, these are the interconnected spaces where bike trails and walking paths intersect with destinations like shopping, work, school, and church. New recreational activities like canoeing, kayaking, cross country skiing, or rock climbing enliven community residents and youth, getting them to explore new paths. Community residents use not only the green spaces themselves, but are more likely to use other connected public places as well. In central city neighborhoods, more green space and youth programming results in less crime and increased perception of safety.[71]

Riverside Park in Milwaukee is located in a dense urban environment and had been largely unused and neglected for many years. The community perceived the park to be unsafe and crime ridden. The Urban Ecology Center (UEC) took up residence in the park in 1991 and began offering programming to neighborhood schools and community residents. UEC worked with the community to advocate for a new community vision for Riverside Park. UEC involves schoolchildren and community residents in efforts to restore the natural areas of Riverside Park; explore the park's ecology; and engage in adventure activities through the park, such as canoeing and kayaking. As a result, Riverside Park is now visited and used by more than 10,000 students a year, has adult evening programs, and promotes environmental stewardship.

Green infrastructure is a place for cultural expression.
Communities can celebrate cultural diversity using open spaces for programming, special events, and unstructured day-to-day use. Groups from different ethnic and social backgrounds use open spaces in different ways. As community members from different cultural groups observe each other using open spaces, this exposure teaches a diverse community about the cultural beliefs and practices of their neighbors.

Specific characteristics of a piece of land can also generate activity within a community. Often associated with historic events, past uses of the land, or cultural references, this historic identity provides added meaning to a community.[72,73,74] As communities develop these open spaces, they have a chance to incorporate and recognize significant events, past uses or historic milestones.
Ping Tom Park in the Chinatown neighborhood of Chicago provides a vibrant riverfront open space that at the same time honors traditional notions of Chinese culture and celebrates the exuberance and diversity of contemporary American life. The landscape architect designers of the park spent a significant amount of time working with the community to understand their goals and desires for the space as well as researching classical Chinese garden design and materials to develop the cultural elements of the park. The result is a park that attracts young and old, Chinese and not, and that plays host to many musical events and cultural festivals, including the annual Dragon Boat Festival, an ancient Chinese tradition. Users include seniors practicing tai chi, children enjoying the playground, family reunions, and people fishing.

Green infrastructure involves people in planning, building, and maintaining their communities.
Green infrastructure "channels positive community participation by getting diverse people to work together toward a shared vision."[75] Participation in green infrastructure planning, implementation, and stewardship increases the sense of ownership that residents feel for their communities. Residents feel empowered when they feel they have a voice in shaping their community, and when their input is implemented throughout the planning process.

A key to community involvement and use is the proximity of the open space to the community. Surveys by the Urban Green Environment (URGE) initiative in Europe found that people closer to an open space took on a closer relationship with that space. "This relationship [between user and space] begins to develop further to form a community relationship in that the closer, well-used site is increasingly adopted by the community as theirs."[76]

Dane County's Token Creek Watershed Forum, an effort of the Natural Heritage Land Trust with continuing support from the Token Creek Watershed Association, provided an opportunity for residents to discuss complex issues and form a vision for their watershed. This process served as a springboard for residents to take responsibility for the watershed, leading to better decision-making. The forum resulted in an ecological, engaging, and cared-for natural resource that provides benefits to the whole region.

The lower basin of the Milwaukee River flowing through the metropolitan Milwaukee area is a wonderful example of place where a number of smaller open spaces that encompass both urban and natural areas are (or soon will be) connected to one another along the river. The communities along the river have a unique culture and history that includes industrial and recreational use of the river. Much of the land along the river is public, providing access for people and habitat for wildlife. Connecting these spaces by making public the areas that are not currently public and restoring some areas to a more natural environment will enhance the river valley, the community, and provide habitat for wildlife along with recreational opportunities for people.

"Participants' satisfaction with their community was strongly related to having views of gardens; views of woods and trees were particularly important factors in several other neighborhood satisfaction measures." In short, neighborhood satisfaction relates to life satisfaction.[77]

In Conclusion: Connecting All the Bridges of Green Infrastructure

"Our attachment to the land is our attachment to each other."

--Terry Tempest Williams (1991)

The many benefits of green infrastructure outlined above represent the best of natural systems—not only the synergies, but the realization that the whole is greater than the sum of its parts. By examining the benefits in discreet sections, but building bridges between them, we aimed to illustrate the overlapping and interconnected strengths that well thought out green infrastructure can add to local communities, local economies, individuals, and the natural world.

We sometimes think of humans as being over, against, or above the natural world and not part of it. This misperception is a consequence of our having been isolated and insulated from the open spaces that surround us. We easily forget that open space provides our food, water, clean air, even our health. It is in a community's open spaces that social connections meet up with ecology, where recreation and vitality connect with aesthetics, sense of place, neighborhood, and nature.

Green open spaces are literally where it all comes together. We must remember our connections to the earth: green infrastructure helps to guarantee the quality of our lives.

How We're Doing: An Assessment of Green Infrastructure in Wisconsin

Wisconsin's urban parks and open spaces are an important starting point for developing comprehensive green infrastructure systems to serve our citizens. The Community Open Space Partnership has charted an ambitious course for open space in cities for the 21st Century. The principles of green infrastructure form the core values of the Community Open Space Partnership. The principles guide the work of all those who seek to make open space a building block of stronger communities. Not every space (real or imagined) will satisfy every principle. Rather, the principles serve as inspiration as we work to improve our system of urban open spaces. Here we use the principles and processes to assess the current condition of Wisconsin's green infrastructure systems.

#1 Equally Available and Accessible. *Every neighborhood has quality open spaces that are inviting and accommodating. Open spaces are located throughout a community so all residents and visitors have access to quality spaces nearby.. Some open spaces meet local needs. Others meet regional needs. Both types of spaces need to be accessible. Open spaces can be used by multiple generations and differing cultures. Individuals of various physical and cognitive abilities can safely access open spaces.*

The current collection of parks in Wisconsin communities was—in most instances—designed to provide specific services (e.g. baseball diamonds, soccer fields) uniformly to all neighborhoods, rather than provide diverse services and types of spaces to meet specific neighborhood and community needs. The National Recreation and Park Association has established standards for public outdoor recreation planning over the past two decades; the standards are made available in its publication titled Recreation, Park and Open Space Standards and Guidelines (Alexandria, VA: National Recreation and Park Association, 1983), and its more recent Park, Recreation, Open Space and Greenway Guidelines (December, 1995). These national publications are often used as guidelines to determine minimum land requirements for various park and recreation area facilities on a per capita basis. While these are important tools to help establish minimum standards for recreational services, they are often misused to establish the maximum vision for open space planning.

A "cookie cutter" approach to open space planning often means that segments of the community's population (including ethnic, age, and specific-use groups) do not have spaces they can use and enjoy. In many inner-city communities, citizens must face toxic environmental hazards: dumping on vacant lots, lead contamination in building materials, polluted air and water, and a shortage of green space and parks. Low-income neighborhoods are the hardest hit by environmental problems; green infrastructure is at the heart of the environmental justice movement. Civic spaces, including parks and open spaces, are most often located in more affluent communities, meaning that under-served neighborhoods have reduced access to their community facilities.

While state and federal legislation has improved the physical accessibility of recently built facilities, many community parks and open spaces remain difficult to reach and use for some. A study conducted by the University of Chicago assessed the recreational activities available in two neighborhoods. It found that the public parks in suburban neighborhoods inhabited by mostly white, middle-income people provide eight times more activities for young people than did the parks in a low-income, minority, inner-city neighborhood.[78]

On December 5, 2002 the Public Policy Forum in Milwaukee released Public Spaces, Public Priorities: An Analysis of Milwaukee County's Parks. While Milwaukee's park system remains an attractive collection of discrete open spaces, many believe the parks are in crisis, with a disparity between the "haves" and "have-nots." The researchers concluded that "overall, we find that parks with higher percent white population, higher median home values, and higher median household incomes are associated with parks with higher impression based scores." Thus, higher rated parks tended to be situated in wealthier suburban neighborhoods; lower rated parks tended to be found in the lower income minority urban neighborhoods.

Cravath Lakefront Park, Whitewater Exemplifies an Equally Available and Accessible Space

The city of Whitewater and the Whitewater Community Development Authority (CDA) created Cravath Lakefront Park to revitalize Whitewater's downtown and lakefront. The park transforms a once-blighted waterfront area into a vibrant open space for residents and visitors at the city's heart. The city's historic downtown breathes new life as people revisit their culture and history in the many festivals and events that find their homes in Cravath Lakefront Park.

Industrial and commercial activities dominated Whitewater's lakefront from its founding in the 1840s until the 1990s. Early users disregarded the lakeshore. By the 1990s, the downtown shoreline was lined with blighted commercial and industrial buildings. Over several years, the City of Whitewater and the Whitewater Community Development Authority (CDA) acquired these dilapidated properties. By transforming the area into a lakefront park, downtown is redefined as the cultural center of the community.

Paths connect the lake to the city's commercial center and to the Whitewater Creek Path.
Connecting the park and revitalized downtown with older neighborhoods and the UW-Whitewater campus reflects historic architectural themes. The project ties together several historically significant city buildings that border Cravath Lakefront Park or lie along the Whitewater Creek Path. The Whitewater Municipal Building extension, the "Old Armory" (adjacent to Brewery Hill Park), Lakefront Center, and the historic depot all attract renewed visitor interest. Lakefront Center reflects the architectural themes of the depot at the foot of the park and is the centerpiece of Cravath Lakefront Park. The 1896 depot is listed on the National Register of Historic Places and houses an historical museum.

Completed in 2001, Cravath Lakefront Park is already beginning to have a significant economic impact on the city, attracting visitors and residents to a year-round calendar of activities. The revitalized lakefront is the scene of a summer concert series, Family Fun Nights, the 4th of July Celebration, Fall Fest, a Christmas Tree Walk, and a stop on the Great Circus Train route. In addition to planned events, visitors enjoy green space for family picnics, fishing excursions, and winter ice-skating in the heart of downtown Whitewater.

Whitewater is realizing the benefits of twenty years of planning and effort. This model project has turned a blighted and environmentally contaminated city center into a showcase lakefront park. Designed as a year-round gathering place, the combination of natural spaces, attractions and events draws residents and visitors into a formerly under-appreciated downtown district.

#2 Safe. *Open spaces are safe places. Open spaces are not only structured physically for safety, but are perceived as havens for everyone. They are not centers of criminal activity. People of all backgrounds and abilities feel comfortable getting to and enjoying these areas. Conflicts between uses are minimized.*

Urban Ecology Center Illustrates How to Create Safe Spaces

It's not clear who benefits more from the work of Ken Leinbach and The Urban Ecology Center (UEC): Milwaukee's Riverwest and East Side neighborhoods or Riverside Park itself. UEC was founded in 1991 to revitalize the park and its surrounding communities, among the most diverse in Milwaukee. What started as a trailer on the site of Riverside Park has grown into a cutting-edge environmental education center serving the entire community. UEC is a neighborhood based, nonprofit community center that uses Riverside Park as a living laboratory. It provides environmental science programs to neighborhood schools, promotes environmental awareness in the community, preserves and enhances the natural

resources of Riverside Park, hosts community activities, and protects an important section of Milwaukee River frontage.

In the early 1900s, the 12-acre wooded Riverside Park was a well-groomed, popular place that attracted Milwaukeeans for swimming, boating, skating, and curling on the Milwaukee River. As industrialization increased and the Milwaukee River became more polluted, the park was essentially abandoned. Along with the river's pollution, community members perceived that the Park's primary user groups were engaged in illicit activities, making the part unsafe.

Today, with the involvement of UEC, the park is becoming a community centerpiece. Each year UEC reaches more than 10,000 school children from 12 neighborhood schools, providing outdoor hands-on learning experiences to enrich the K-12 science curriculum. UEC also provides family programs; adult lectures, workshops, and discussions; and urban adventures including hiking, rock climbing, canoeing, and kayaking. A summer time Youth Camp helps campers explore their interests using green spaces located in Milwaukee and surrounding areas. UEC also hosts a variety of community programs including urban stargazers and the Riverside Camera Club. It is in charge of organizing stewardship efforts to restore the park, providing a richer nature experience for visitors.

Funding for UEC comes from a variety of sources, including donations from friends, program fees, grants, and annual fund raising events. UEC is in the midst of a capital campaign to raise some $5 million to support construction and development of a new building to house UEC's programs. A lead gift of $2.2 million from the Trinity Foundation kicked off the campaign in the fall of 2002.[79]

#3 Diverse. All community residents and visitors can access a variety of open spaces that support diverse uses. Communities have open spaces of various sizes supporting a variety of uses and purposes to accommodate diverse user groups. Open space designs can be adapted to meet changing local and regional needs, without diminishing the experience of a coherent and unified space.

Because of a "cookie cutter" approach to park and open space development that is commonly used, diversity in size, uses, purposes, and specific-use groups is often lacking in park and open space systems. More fundamentally, most parks and open spaces are designed with particular user groups and purposes in mind, with no plan or funding for adapting to changes as the needs of the community and likely users evolve. In one Wisconsin community, a park was designed more than four decades ago to meet the needs of the residents from primarily German backgrounds who then comprised the community. In recent years, the demographics of the community have shifted dramatically: most residents today are African-American and Asian-American. The design of the park no longer meets the needs of the residents, and as a result the space is under-utilized and the needs of the residents are unmet.

Menomonee Valley Redevelopment Proposes Many Paths to Diverse Uses

Visionary leaders are spearheading a process to restore the post-industrial Menomonee River valley that runs through Milwaukee's heart. Its facelift will include a variety of projects to transform a wasteland into a culturally, ecologically, and economically vibrant space in the center of Milwaukee.

In the early 1900s, the valley was transformed into a bustling industrial center employing more than 50,000 people. Today, the valley is a vast 1200-acre brownfield, reaching from Miller Park to downtown. A visible eyesore, it is scattered with decaying factories, abandoned weed-choked lots, and nineteenth-century industrial ruins.

Revitalizing the valley will address a variety of needs of area stakeholders, including businesses based in and near the valley, educational institutions such as Marquette University, and the lowest-income, highest-density residential neighborhoods in Wisconsin.

In 2002, Menomonee Valley Partners, Inc. surveyed surrounding neighborhood communities to document past and current connections to the Menomonee River Valley, gathering these stakeholders' visions for a redeveloped valley. These results were the basis for a landscape design competition for the Menomonee Valley in 2002. The winner will guide redevelopment efforts.

Numerous separate projects will be required to revitalize the valley for the entire Milwaukee

community. The Pre-development Program will provide funds for brownfield clean-up. Sustainable Design Guidelines will direct developments in the Valley.

The new Valley West conceptual plan integrates a storm water park and river park on 140 acres of blighted industrial land. The storm water park will treat runoff through a storm water treatment train and succession of native landscapes such as wet prairie, swamp forest and emergent wetland. The River Park will restore in-stream habitat for wildlife and provide river access.

Athletic fields will support the needs of nearby educational institutions and neighboring communities for whom soccer is an important part of social and cultural life. Other open space areas will host community events.

Over the next ten years, a public and private sector team will oversee this network of interconnected projects designed to recreate the post-industrial Menomonee River Valley into a vibrant city center filled with diverse activities that connect culturally, ecologically, and economically with Milwaukee's communities. The many aspects of the plan will address needs of the Marquette University community, nearby Latino neighborhoods, industrial workers, and offer environmental benefits as well as bike paths, soccer fields, and informal picnic facilities.

#4 Connected. A network of spaces enhances other public places and civic amenities. Communities and regions have networks of open spaces. Interconnected spaces provide greater opportunities and more diverse experiences. Connected spaces enhance ecological diversity and functions. Open spaces are connected to public transportation and pedestrian facilities. Libraries, schools, courthouses, and other public facilities include open space.

When people think about connection, trails are the first things that come to mind. Many communities in Wisconsin are developing trail systems, and many are working to connect their trails with those of neighboring communities. But the Community Open Space Partnership envisions more than trails when it considers open space connectivity., In this, most Wisconsin communities come up short. Often services like public transportation, libraries, museums, and other cultural venues are not effectively connected with open spaces, nor do they include accessible open space in their design. Access is limited for biking and walking, making these sites less inviting and often under-used. Unconnected open spaces are less able to provide ecological services like absorbing or detaining stormwater or providing habitat corridors for plants and wildlife.

Pedestrian streets and boulevards in Wisconsin's communities are tremendously important to consider when designing green infrastructure systems. Streets, along with vacant lots, rail corridors, and brown fields, are part of the essential building blocks for a system.

Capitol Square and the Pedestrian-based State Street Mall in Madison Show How to Connect

The Capitol Square in Madison is a popular public gathering place for the people of Madison and Wisconsin's citizens. Encircling the state capitol with a wreath of stately oaks and colorful flowers, Capitol Square is an attractive and inviting public open space. Located in Madison's downtown government district,

the park seldom languishes from under-use, even on weekends and evenings when most government offices are closed. Capitol Square is a community gathering point and centerpiece as it hosts a variety of community events year round, including the seasonal Farmer's Market, Concerts on the Square and numerous parades.

Well-connected to the area's bicycle trail network and serving as a hub for the city's public transportation system, the Square is easily accessible without a car. It is close to a variety of other public facilities, including the Monona Terrace Community and Convention Center, the Historical Society of Wisconsin, the Wisconsin Veterans Museum, Madison Children's Museum, government offices, and the main branch of the Madison Public Library. State Street connects Capitol Square to the campus of the University of Wisconsin-Madison. Centrally located, pedestrian-friendly, and connected to popular nearby destinations, Madison's Capitol Square is a model for creating smart connections.

#5 Ecologically sound. Open spaces provide environmental benefits. Open spaces address large-scale concerns. They provide habitat, minimize storm water runoff, infiltrate groundwater, and offer other environmental benefits. These are spaces where people can connect with nature.

Wisconsin's urban communities face many environmental concerns, chief among them storm water management and flood prevention, water quality, ground water infiltration and aquifer recharge, and air quality. Our collection of parks and open spaces do not, in their current state, address these large-scale ecological concerns. Engineered solutions are not only very expensive, but are often ineffective over the long term as well. Creating solutions through green infrastructure is not yet widely practiced.

Pheasant Branch Conservancy Lives up to Ecologically Sound Principles

Pheasant Branch Conservancy is a regionally significant natural area located on the north side of Middleton, Wisconsin. It contains a marsh with open water, springs, prairies, meadows, lowland forests, and wooded hills. These various habitats sustain a wide variety of plants and animals, including some that are threatened or endangered. Visitors often hear or see deer, herons, frogs, Sandhill cranes, ducks, geese, hawks, owls and dozens of different songbirds.

Although surrounded on three sides by urban development, the conservancy provides a quiet refuge for bird-watchers, nature enthusiasts and hikers. Its unique resources also offer an outdoor classroom and laboratory for students of all ages.

Parts of the conservancy are owned by Dane County Parks Department, City of Middleton and Wisconsin Department of Natural Resources, but resources in this 500-acre property are managed as a single unit by city and county staff, and supported by Friends of Pheasant Branch volunteers.

The Dane County property at the northern end of the conservancy includes a prominent hill with a group of Indian mounds and an observation platform that overlooks the marsh. Below the hill, another observation platform allows visitors to view one of two large sets of springs in the conservancy. Each day more than 2.6 million gallons of fresh, clear water flow from these springs into the marsh and Lake Mendota.

This ecological urban open space offers regional and local environmental benefits, providing habitat, minimizing storm water runoff, filtering groundwater, and protecting natural springs. It also

provides excellent opportunities for people to connect with nature.

#6 Engaging. Open spaces promote cultural understanding, interpret environmental and cultural identities, and foster community pride. Open spaces provide opportunities for multiple experiences. The design, materials, and uses reflect elements rooted in community values, history, and cultural links. Open spaces help define a community as they positively affect the physical, emotional, cognitive, and spiritual growth of citizens.

Few places are designed to reflect community values, history, and cultural links. This approach is gaining currency as seen in more recent projects such as the Menomonee Valley redevelopment plan in Milwaukee as well as that city's desire to embrace the cultural heritage of the Native American community. Parks and open spaces are frequently designed with limited experiences available (e.g., soccer fields, ball fields, picnic grounds) rather than opening to possibilities of user-defined cultural experiences. As a result, the physical, emotional, cognitive, and spiritual growth of citizens is not encouraged to the extent possible.

Appleton's Vulcan Heritage Park Engages Its History

The city of Appleton and its partners are working to honor a unique feature of the city's industrial heritage while bringing city residents and visitors back to the Fox River at Vulcan Heritage Park.

When the Vulcan Street Plant began operation in November 1892, Appleton became the first place in the world to have an Edison 'Dynamo' hydroelectric central station serving a system of private and commercial customers. At one point in this early history, only three places in the world had an Edison Dynamo in operation: London, England, New York City, and Appleton, Wisconsin. This important first gave a big boost to the community's growth. It facilitated the development of electric lights, a telephone system, a trolley system for public transportation in the city, and the development of paper mills that brought economic prosperity to the area. Appleton was one of the earliest communities to light the city with electric lights rather than gas.

Vulcan Heritage Park preserves this important chapter in Appleton's history by incorporating the original Vulcan hydroelectric plant, surrounding it with a city park. An elevated boardwalk gives visitors views of the river and a newer hydroelectric dam. A wild area of the park provides habitat for wildlife, particularly waterfowl that live along the river. Picnic areas and open spaces offer more active recreation in the park. Many of these areas are built on filled-in former canals that served the old power plant. Not only was land created for the park, but PCB contamination was cleaned up through the fill process with the help of the US Army Corps of Engineers.

Funding for the park came from a variety of sources, including both public and private money. The property, formerly owned by the Fox River Paper Company and later WE Energies, was sold to the city of Appleton., Matching funds for the acquisition came from the state of Wisconsin. WE Energies made a gift to the city for the full amount of the original sale. This money will be used to develop the park facilities, including interpretive signage to help park users understand the unique history of the site in downtown Appleton.

#7 Cared for. *Citizens care for open spaces and foster an appreciation of nature in their families and neighborhoods. Communities demonstrate their caring in many ways as citizens of varied talents and interests devote time and resources to open space planning and management.*

Today, citizen involvement in managing parks and open spaces is growing but remains limited, despite the fact that park departments are notoriously under-funded. Professionally organized and managed volunteer programs can save local municipalities significant money. However, labor unions often object to volunteer programs, as they perceive these programs as a direct threat to employment and job security. One strategy for successfully negotiating active municipal volunteer programs is to establish clear guidelines as to the tasks to be completed by volunteers, and the tasks requiring professionals

Citizens are seldom represented at the critical early planning stages for most projects. At this point, Wisconsin communities often take a "top down" planning approach. Parks and planning departments typically create plans and citizens provide review

of these proposals late in the process. Many park departments wish for more community feedback and are puzzled by the lack of civic interest and engagement. To make that happen, citizens must be involved all along—from visioning to planning through the design processes. Such involvement develops a sense of ownership, and a sense of responsibility for stewardship.

Caring for the Community Gardens at Dr. Martin Luther King, Jr. School

The teachers, parents, and students at Dr. Martin Luther King, Jr. Elementary school in Milwaukee saw opportunity in the lot with a dilapidated house across the street from the school. When the students wrote letters to their local council representative, they got action. The house was torn down, and the city leased the lot to the school for a community garden. The school transformed the unsightly property into a hands-on learning laboratory for students, providing a lesson in community-driven open space development for the rest of us.

The school turned the lot into a community garden run by students with help from engaged parents, teachers, and community residents. They do all the work, from planning through planting, weeding, and harvesting. When the garden is harvested, students use what they grow in their classrooms, learning about the vegetables and preparation. They tied in history the season they grew peanuts then studied George Washington Carver. In addition, members of the community are invited to partake in the harvest, picking what they can use-- green beans, tomatoes, okra, black eyed peas, and more. The school makes sure that the neighborhood families who help with weeding and watering over the summer get their share of the garden's bounty.

Through their work in the school's community gardens, these inner city youngsters from an economically disadvantaged community get a rare opportunity to interact with the natural world. They are learning first hand where food comes from. As they grow the fruits and vegetables they eat and the flowers they smell, they learn that these things really come from somewhere other than the grocery store. This cared-for open space provides the community with a venue for coming together to foster an appreciation of natural processes while cultivating nourishment with families and neighbors. Early in the process, the school also engaged with business partners for needed expertise, tools and supplies.

#8 Funded. *Communities sufficiently fund open space planning and management to meet citizen needs and community goals. Open spaces, like highways and sewers, require investments to reap community benefits. The long-term success of open space also requires long-term commitment and maintenance to protect the quality of the environment and visitor enjoyment.*

Funding is a challenge for all entities working to establish and maintain urban open spaces in Wisconsin. While communities maintain large budgets for highway and road maintenance and construction, budgets for open space languish. Even when funds for acquisition are made available, these funds are rarely paired with long-term funding for maintenance and stewardship. Or, the funds are limited to land acquisition and do not cover development of facilities within open spaces. Our community open space networks suffer greatly as a result.

Dane County Collaborators Commit to Funding with the Park and Open Space Referendum

At the close of the twentieth century, leaders in Dane County saw their chance for protecting open space passing quickly in the fast-growing metropolitan region. They began to work towards a ballot referendum to authorize spending for land protection. They knew that strong public support would be essential.

Dane County Executive Kathleen Falk and others came together to form an innovative coalition to ensure passage of the referendum. The environmental community worked with the builder and realtor communities – groups often perceived as foes of land protection initiatives. All of these groups collectively recognized that targeted land protection for parks and open spaces would improve the local economy and make Dane County a better place to live. They also knew that the existing Conservation Fund must increase to meet the needs of a county with rising development demands and escalating land prices.

The coalition showed through objective polling that citizens supported the idea of increased taxes *if* they knew the money was going for land protection. The Dane County Parks and Open Space Referendum passed in 1999 with the support of more than 76% of the voters. As a result, Dane County put into place in 2000 the new Conservation Fund: a program to provide up to $3 million annually (and up to $30 million over ten years) for park and open space acquisition to achieve the goals laid out in the 1996-2000 Dane County Parks and Open Space Plan.

Following passage of the referendum, the innovative partnerships continued. The Conservation Fund recognizes the importance of partnerships between the county and non-profit groups, local governments, and other community organizations in achieving the goals of the Parks and Open Space Plan. Through the fund, partner groups are eligible to compete for funding with a 50% cost-share grants program to purchase qualifying properties and easements. This arrangement leverages the county's investment in open space protection, providing additional dollars to purchase land identified in the County's Plan.

By bringing together a variety of partners, united in understanding the connection between land conservation and economic vitality, the Dane County Conservation Fund is providing the financial resources necessary to preserve Dane County's natural heritage for generations to come.

The following processes are the critical underpinning to achieving our principles.

#9 Community-Driven. *Open space planning and decision-making reflect community values, respond to citizens' needs, and address broader community goals. Citizens create a vision to preserve and enhance open space. Communities address open space needs in relation to other goals, including local and regional economic priorities, social development objectives, and a local vision of community character. Citizens identify community assets, such as civic buildings, community organizations, and natural features that can be enhanced through strategic investments in open space.*

Rarely are citizens involved in a sufficiently rich discussion of the community's vision for itself: defining important goals and priorities for the community; identifying community assets and character; and developing economic, environmental, and social objectives. Citizens frequently get involved with planning-related issues in a "crisis management" mode, late in the process because of opposition to draft plans. Open space planning is too often a "top down" decision-making process. Instead, citizens should drive planning efforts, not merely respond to draft plans.

Baird Creek Greenway Illustrates Community Driven Processes

The most extensive area of greenspace within the Green Bay city limits lies within the Baird Creek Greenway, a 375-acre, 3- mile long wooded stream corridor on the east side of Green Bay. The greenway contains important physical features that tell the story of Wisconsin's glacial past. It also protects woodland, wetland, grassland, and riparian ecosystems along Baird Creek that provide critical wildlife habitat. It's home to several species that have become rare elsewhere in Brown County. Breeding birds like wood thrush, scarlet tanager, and ovenbird that populate the greenway are indicators of a high quality forest ecosystem. The protected areas of the greenway also help improve water quality, manage the area's flood and storm water, and leave a legacy of natural heritage for future generations. The residents of Green Bay have many opportunities to enjoy and learn more about nature in the greenway through biking, walking, bird-watching, and cross-country skiing.

Concerned citizens came together in 1997 to protect a critical 35-acre parcel that was threatened by pending development within the planned greenway area. The Baird Creek Parkway Preservation Foundation, as these citizens came to be known, spearheaded the acquisition of this key link in the Baird Creek

Greenway system. The area contained areas of old growth forest and a high diversity of plants and animals. A community-wide fundraising campaign resulted in individuals, community organizations, school groups, foundations, and government successfully working together to purchase the parcel.

As part of its efforts, the Foundation retained the services of Applied Ecological Services (AES) in 2002 to map, assess, and document the current ecological condition and potential threats to the ecological health of the greenway. These recommendations will be submitted to the city of Green Bay to incorporate into the city's master plan for the greenway and surrounding areas.

The Foundation continues in its mission to assist the city of Green Bay, acquiring land in the Baird Creek Greenway and enhancing the Greenway's value as an ecological and educational resource for northeastern Wisconsin. Working together, the Baird Creek Parkway Preservation Foundation and the City of Green Bay Parks, Recreation, and Forestry Department hope to protect the more than 300 acres of designated greenway that still need to be acquired to preserve this special urban treasure.

This ecological open space provides habitat, minimizes storm water runoff, filters groundwater, and offers other environmental benefits. It provides wonderful opportunities for the residents and visitors of Green Bay to connect with nature.

#10 Inclusive. Everyone is welcome in the open space planning and decision-making process. Participation by community residents of all backgrounds and diverse interests drives the planning and design process. Traditional and non-traditional partners are sought out and included.

Today, public outreach and community involvement tools are not widely known or utilized in open space planning in Wisconsin. Often, planners perceive community involvement as inefficient and impractical given scarce resources. Consequently, community residents are not often enough or deeply enough involved with community planning efforts. Few are involved, representing but a narrow slice of a diverse community.

East Rail Corridor Maintains an Inclusive Process

Imagine Madison with a village in its midst: a revitalized and reinvested East Rail Corridor. The Corridor already has the advantage of its location near downtown. Soon it will have its own Central Park, surrounded by small businesses, well-designed multi-family homes (new and old), light manufacturing, and office buildings. It will be a place where people can walk to work and cultural events, where they can enjoy all the amenities of living close to the heart of the city. It will be a truly urban neighborhood where work, recreation, and residence are fully integrated.

This bold vision is possible because of a high degree of cooperation and an inclusive collaborative effort. At the urging of the Urban Open Space Foundation, the City of Madison convened the East Rail Corridor Plan Advisory Committee in 2001. Their mission: to create a plan for the entire industrial zone on the East Isthmus, a total of about 32 blocks. The Committee was charged with recommending a land-use plan that integrates economic development, housing, and open space. The Committee's members include representatives of the Urban Open Space Foundation, the city's Department of Planning and Development, MG&E, the Marquette Neighborhood Association, Common Wealth Development, the Chamber of Commerce, Downtown Madison Inc., local businesses, local landowners, and other concerned citizens. The Madison Common Council approved the land-use plan drafted by this Committee in March 2002.

At the same time, the Urban Open Space Foundation (UOSF) has worked to make sure that many people have given voice to what Central Park should look like. UOSF held a series of workshops over the course of two years to develop the vision for the park, followed by more detailed plans. Through this process, people in the community voiced their concerns and goals for the project to guide the park's design.

Support from elected officials at all levels has been a key component of the park concept's success so far and of its feasibility in the future. City Alders and two consecutive Mayors have been vocal supporters, as have the Dane County Executive, the Dane County Board, and State Representatives. The Marquette Neighborhood Association has passed a resolution in favor of the park. US Representative Tammy Baldwin and US Senator Herb Kohl worked to secure funding

for the Central Park effort in the 2002 budget.

Local and state agencies have also played key roles, including the state Department of Natural Resources, the Madison Planning Commission, the City Departments of Planning and Development, Parks, and Public Works.

The East Rail Corridor is important in the economic and transportation future of the city, as private planning firms have indicated. They helped the process by providing a better understanding and appreciation of the regional transportation issues. MG&E, a major corridor landowner and business, has funded these efforts.

While it will be several years before the transformation of the East Rail Corridor and the construction of Central Park is complete, the future success of these initiatives is possible because of the inclusive vision and planning processes.

#11 Informed by science. *Decision-makers use sound scientific principles based on environmental evidence in open space planning and management. The siting and design of open space consistently incorporates proven scientific principles regarding ecosystems and the connection between land and water resources. Planning for public open space recognizes that open space can function as a system if it is designed* with *nature, instead of* in spite of *nature. While managing and funding open space may continue to respect established political boundaries, planning for open space should address the regional ecosystem and watershed contexts.*

Historically, open space planning has occurred without scientific principles based on environmental evidence underlying decision-making. As a result, many of our forests, streams, and other natural resources have been consumed, paved over, or put at risk. Wisconsin's communities have paid—and continue to pay—a high cost for the lack of scientific and environmental principles in decision-making. This results in flooding, poor water quality, and expensive engineered "fixes" to today's environmental problems.

Basing decision-making on scientific principles requires coordination across jurisdictions. The political boundaries of human communities do not reflect ecological boundaries. Planning often does not recognize regional ecosystem contexts, often making ecological problems worse. One community may have good watershed planning, with protected open spaces critical to providing flood storage. If communities upstream do not similarly plan, the neighbors downstream will find their efforts washed out.

Milwaukee Metropolitan Sewerage District (MMSD) Follows Environmental Evidence and Scientific Principles

The Milwaukee Metropolitan Sewerage District (MMSD) is conserving green infrastructure and natural systems networks based on sound scientific principles as they create the "Conservation Plan." MMSD recognized that demographic and community development trends over 20 years would make existing flood problems worse within three Milwaukee-area watersheds. MMSD worked with the national nonprofit, The Conservation Fund, and other partners to analyze undeveloped land in the three watersheds. They've identified 41 sites totaling 7,065 acres that contain necessary soil conditions to provide future flood reduction benefits.

When lands are preserved for flood storage, national studies show an 8-to-1 dollar savings ratio versus man-made flood control structures. The Conservation Fund estimates that the sites identified in MMSD's Conservation Plan could provide 4.7 billion gallons of water storage. The sites range in size from 30 acres to 674 acres. MMSD is now putting the plan into action. They are working with The Conservation Fund, local community groups, municipalities, and others to acquire or get easements on properties identified as critical to protecting against future flooding in the Menomonee River, Oak Creek and Root River watersheds.

#12 Innovative. *Communities achieve creative solutions through innovative partnerships. Park professionals, community organizers, and public officials seek out creative partnerships and use collaborative processes to carry out visionary strategies for acquiring, funding, and managing open space.*

Government alone cannot accomplish the enormous task of planning for, protecting, and managing open spaces necessary for our communities' health and prosperity. Financial resources are limited, as is the capacity of municipal and agency staff, already burdened with numerous responsibilities. Nonprofit agencies do not have the capacity to do the "heavy lifting" some urban redevelopment initiatives require. Developing creative partnerships is essential to assembling the resources, ideas, and political will to successfully acquire, fund, and manage open space. In order for such partnerships to work, a collaborative process is essential to bringing partners together.

Green Circle Trail Embodies Innovative Solutions in the Stevens Point area

An innovative cooperative effort in the 1990s resulted in the 24-mile circle trail that weaves through Stevens Point and adjacent communities. The effort brought together neighboring municipalities and the people of Portage County. Private landowners, local units of government, UW-Stevens Point, public utilities, state and federal agencies, and area citizens all collaborated to envision and build a trail that could unite the area in enjoyment of the site.
The trail meanders through peaceful pine woods, along streams and rivers, and through wildlife viewing areas, providing a great place to hike, bird, walk, jog, or ski. Schmeeckle Reserve is the headquarters of the Green Circle Trail, where visitors can obtain information, maps, and gift items. The partnership has funded trail and facility improvements, as has an endowment administered by the Community Foundation of Portage County.

Conclusion: Where We Stand Now

The Community Open Space Partnership's principles and processes can be illustrated by existing and developing green infrastructure projects. While Wisconsin's green infrastructure currently falls short of its potential, these examples are but a few of the many efforts and projects that provide hope for the future. Through developing and promoting a vibrant vision for green infrastructure in Wisconsin, the Community Open Space Partnership strives to lay the groundwork for improving and expanding these networks in the 21st Century, ultimately achieving our ambitious vision.

Conclusions and a Call to Action

Today, the State of Wisconsin does not have a green infrastructure policy to bring coherence to the many dimensions of land use, community development, and governance that can affect the development of green infrastructure, open spaces and networks of natural systems. The goal of the Community Open Space Partnership's efforts in shaping Wisconsin's green infrastructure policy is to insure economically, socially, and environmentally sustainable communities, for this generation and all generations to come. The Partnership seeks to foster land use development patterns that 1) honor natural systems supporting quality of life, 2) create a strong economy, and 3) engage the public in land use decision-making processes that respect the broad range of community opinions and objectives.

The purpose of this chapter is to outline a series of recommendations to transform state and local policies to better support the development of green infrastructure. Further, the Community Open Space Partnership identifies who needs to do what in order to implement these recommendations. Further, we recognize that **policy** means an organized and established set of ideas, system, or form of government, which has been officially agreed upon by a group of people, government, or administration; the conduct of public affairs.

As noted by William H. Whyte forty years ago in *Open Space Action*[41] (1962), "the most important land to acquire is the land where people are." He also observed "local government simply cannot carry the financial load of the job."[80] State, federal, and private sector initiatives are therefore critical.

Before presenting recommendations for improving the state of green infrastructure in Wisconsin, it is important to understand the major players whose work and responsibility affect whether and how green infrastructure is implemented.

Who is Influencing Green Infrastructure Development in Wisconsin?

State Government

The State of Wisconsin has several programs administered by state agencies that, while not labeled as "green infrastructure programs," can have a significant influence on the development of green infrastructure.

The Wisconsin Department of Natural Resources and its Knowles Nelson Stewardship Fund relates to green infrastructure. While some think green infrastructure should be the responsibility of the Department of Natural Resources, the Community Open Space Partnership recommends that green infrastructure should not be the responsibility of any one particular state agency.

Other state agencies with programs affecting green infrastructure include the Department of Transportation, the Department of Agriculture, Trade, and Consumer Protection, and the Department of Commerce. Specifically, the Wisconsin Department of Transportation was a pioneer in the development of green infrastructure beginning in the 1950s with the acquisition of scenic conservation easements as part of the Great River Road project along the Mississippi River. Further research is needed on how the Department of Transportation and others can build on this legacy and promote the development of green infrastructure.

Conversely, some state programs may act as a disincentive to the development of green infrastructure. Disincentives must also be evaluated.

The Hank Aaron State Trail is a six-mile long multi-purpose trail slated to run through the Menomonee Valley of Milwaukee. The proposed trail cuts through three of the most densely populated residential neighborhoods in the city, connecting them with industrial yards, commercial areas, and recreational facilities. The proposed trail crosses land owned by private interests, the city, and the state. The trail is a state project, intended to provide the missing link connecting two existing pieces of a statewide trails system. However, because it is perceived by some to be a project with limited statewide significance or benefit, state financial support has been difficult to obtain. This difficulty is exacerbated by the fact that the fiscal challenges in carrying out green infrastructure in urban communities are often not understood by statewide decision-makers. Green infrastructure is inherently more expensive to establish in cities than in rural areas, however the benefits generated can reap great cost savings, and the number of people urban public lands serves is large. The state needs to identify mechanisms through which funding can be provided to both rural and urban green infrastructure projects without undo competition.

Regional Planning Commissions

Currently all but five of Wisconsin's counties fall within the jurisdiction of a regional planning commission. While regional planning commissions have very limited authority to direct development, the work of the regional planning commissions can influence green infrastructure because their plans guide local government decisions. Influence is greatest in those cases where the regional planning commission is also the metropolitan planning organization responsible for transportation planning, and the designated water quality planning organization responsible for sewer service area planning. The regional planning commissions can also use green infrastructure as an organizing feature for the development of regional comprehensive plans.

Local Government

Local governments in Wisconsin (counties, cities, villages, and towns) have numerous tools that can directly influence the development of green infrastructure within their respective communities. Opportunities for local green infrastructure decisions occur when community leaders consider:

- Use and/or transfer of surplus properties owned by the local government
- Decisions surrounding tax forfeited properties
- Construction of new capital facilities and reuse of existing public facilities
- Types of facilities constructed through the use of storm water utility funds
- Type of facilities constructed using tax increment financing funds
- Type of park and open space facilities included in local park and open space plans
- Different funding sources used for parks and open space acquisitions (general revenue, bonding, sales tax)

The standards affecting the design of new development projects can impact green infrastructure. Specific ordinances include:

- Storm water management ordinances
- Infrastructure standards in subdivision ordinances
- Public park and open space dedication requirements in subdivision ordinances
- Impact fee ordinances

Further research is needed to clarify when, where and how local communities use these tools. Research may be complicated by local variations; for example, an ordinance that discourages the development of green infrastructure in one community may in fact have an opposite impact in an adjacent community. Nonetheless, this research could highlight communities that use these tools to promote green infrastructure, and contrast examples that discourage the development of green infrastructure.

The Village of Elm Grove is devising a plan to address downtown flooding problems caused by Underwood Creek. The creek is currently sealed underground inside a cement channel and flows beneath Elm Grove's downtown parking lots and businesses. Through the leadership of a creative and determined citizen on the Village's Master Planning Committee, the City is now considering a master plan that would "daylight" the creek, restoring its aboveground channel while addressing the Village's flooding, water detention storage, run-off, and poor water quality concerns. Restoration of the creek will bring green infrastructure to the downtown, attracting community involvement and improving business. The proposed master plan seeks to address both environmental and economic concerns, and therefore involves players from all sectors of the Village. Statewide policy on green infrastructure would provide the needed justification and support for local communities to take innovative steps like the one being considered by the Village of Elm Grove.

Non-governmental initiatives

Non-profit organizations, educational institutions, and other non-governmental groups have the opportunity to play a major role in the development of green infrastructure to benefit the public. Private land trusts also work to acquire and manage green infrastructure. "Friends of . . ." organizations can help to provide financial support, volunteer labor, and education for parks and urban open space.

The potential for private sector involvement in green infrastructure is limitless and not yet realized. For example, many private foundations and philanthropic individuals help fund such things as urban ecological restoration work and the acquisition of park and open space lands. And yet, "the environmental justice movement is perhaps the most under funded social movement in the United States"[81]

The Indian Nations

Wisconsin is home to eleven federally recognized sovereign Indian nations. Many Indian nations have an historic tradition of caring for the land. Green infrastructure planning can be a logical and heart-felt continuation of this tradition. There are opportunities for state and local governments to form partnerships with Indian nations to promote green infrastructure.

A Call to Action

The Community Open Space Partnership is inspired by the promise of green infrastructure for the 21st Century. However, we are realists. We recognize that Wisconsin is a long way from achieving a seamless interconnected web of open space that winds through every neighborhood connecting our rural countryside with the heart of our downtowns. To accomplish this vision, steps must be taken to:

- Build the capacity of communities to undertake and complete these projects
- Build broad commitment to the goals and objectives of green infrastructure
- Create effective strategies to implement the vision
- Build momentum by demonstrating success and maximizing returns on investments
- Improve communication among all who have an interest in the long-term health of Wisconsin's cities

What follows is a call to action: recommendations from the Community Open Space Partnership on what needs to happen for a green infrastructure movement to achieve success. This is our "G.I.F.T." to Wisconsin; it is how—together—we will achieve Green Infrastructure for Tomorrow.

Action Steps

Goal #1

Build the capacity of communities to undertake and complete these green infrastructure projects.

WHO
Wisconsin State Legislature

ACTION STEP
Establish 1) an Urban Stewardship Program to share costs with local governments, and 2) establish enabling legislation for local governments to create special open space districts

OUTCOME
Communities can focus on achieving regional environmental, social, and economic goals while accessing sufficient funding to acquire and improve open space

WHO
Local government units

ACTION STEP
Fund green infrastructure projects through existing yet innovative techniques, like TIF districts, special assessment districts, CDBG funds, local ballot referendums, and capital campaigns

OUTCOME
Communities will be building creative partnerships and collaborative processes with park professionals, community organizers, and public officials as they utilize all funding strategies.

WHO
Open space and planning professionals

ACTION STEP
Build bridges between diverse groups who care about the health of their cities through innovative,

participatory, and collaborative green infrastructure planning and implementation processes

OUTCOME
Regional open spaces will reflect community values and respond to citizen needs while addressing broad community goals.

WHO
University professors, researchers, and NGO leaders

ACTION STEP
Research the costs and benefits of establishing green infrastructure networks

OUTCOME
Community leaders can use objective data to evaluate the environmental, social and economic effects of green infrastructure in Wisconsin.

WHO
Local nonprofits, Community Open Space Partnership members and community foundations

ACTION STEP
Educate interlinked local collaborators to build on their commitments to community improvement

OUTCOME
Communities will attract grassroots philanthropic support for community transformation through the use of open space and green infrastructure

WHO
Citizens committed to improving the health of their cities

ACTION STEP
Mobilize networks and "Friends of" groups to reach out to the broadest spectrum of citizens in the community

OUTCOME
Getting citizen buy-in from the beginning increases political, management, advocacy, volunteer, and funding support at each step in the process.

Goal #2

Build broad commitment to the goals and objectives of green infrastructure

WHO
Wisconsin's governor

ACTION STEP
Establish a task force devoted to this complex policy issue

OUTCOME
By developing a comprehensive vision for Wisconsin's cities, we will generate the political will and needed coherence to support green infrastructure.

WHO
Local nonprofits and members of the Community Open Space Partnership

ACTION STEP
Educate decision-makers about the benefits of green infrastructure networks

OUTCOME
With a shared understanding of the benefits, decision-makers will come to realize that green infrastructure networks are essential--- environmentally, socially, and economically--- for sustaining the property tax base and citizens' quality of life.

WHO
Schools, churches, nonprofit agencies

ACTION STEP
Connect citizens to the importance of green infrastructure through dialogues at community forums and hands-on experiences with the natural world.

OUTCOME
Encouraging a sense of connection and interdependency between people and the natural world will increase participation in open space planning while better reflecting community values.

WHO
Local governments

ACTION STEP
Align local zoning and subdivision ordinances, building codes, landscape and architectural control regulations, sign and storm water management ordinances to implement green infrastructure systems

OUTCOME
Communities will be able to achieve broad green infrastructure goals using the many available land use tools.

WHO
Local law enforcement

ACTION STEP
Develop active partnerships between police and community groups relating to designing, maintaining and overseeing the safety of open spaces through neighborhood watch groups, design guidelines, and other safety enhancement tools

OUTCOME
Residents can see that open spaces are safe, not centers for illegal activity.

WHO
Governments, nonprofits, churches, businesses and citizen leaders

ACTION STEP
Commit to build local collaborations to address environmental justice issues

OUTCOME
Communities will experience improved environmental health for all, including citizens of color and marginalized communities, and everyone will be welcome to access the variety of open spaces.

Goal #3
Create effective strategies to implement the Vision

WHO
Real estate developers, universities, and nonprofits

ACTION STEP
Provide alternative models for local development and redevelopment, along with cost benefit analyses

OUTCOME
Communities will improve local economies, maximize returns to tax base, and enhance quality of life by leveraging rising property values on land close to green infrastructure.

WHO
Landscape architects, nonprofits, Community Open Space Partnership

ACTION STEP
Learn to advise communities how they can achieve integrated comprehensive green infrastructure systems

OUTCOME
The community network of green infrastructure will enhance existing public spaces and amenities, while enhancing ecological diversity and creating cost-effective environmental systems.

WHO
Land use planners

ACTION STEP
Bring cohesion to the required elements of Wisconsin's Smart Growth Planning by integrating green infrastructure elements into all aspects of the process

OUTCOME
Communities will have access to cost-effective natural solutions to planning challenges. They will be able to design sustainable futures by incorporating natural processes within economic, transportation, agricultural and other systems.

WHO
Department of Transportation

ACTION STEP
Revise departmental policies to meet transportation needs while implementing local land use and green infrastructure plans and protecting wildlife migration corridors

OUTCOME
By honoring local and regional land use plans while meeting transportation needs simultaneously, the Department of Transportation will become a positive partner in building community open space.

WHO
Nonprofits, private sector businesses, Department of Natural Resources

ACTION STEP
Streamline rules, regulations and policies for compatibility to reach the larger Vision

OUTCOME
Identifying and resolving incompatibilities will produce coherent policies that support a larger win-win goal.

Goal #4

Build momentum by demonstrating success and maximizing returns on investments

WHO
Open space planners and designers, green infrastructure pioneers

ACTION STEP
Develop multi-pronged conservation strategies that connect economics, local history, cultural diversity, and sustainable environmental decision-making

OUTCOME
By stepping beyond traditional models, communities will gain plans that encourage economic investment,

promote cultural understanding, and foster community pride.

WHO
Municipal governments, nonprofits, friends-of groups

ACTION STEP
Develop community-driven public decision-making processes focusing on regional vision and goals

OUTCOME
By drawing on grassroots community support, these new open spaces can be created, acquired, funded and managed in a collaborative and comprehensive community-based process.

WHO
Open space planners

ACTION STEP
Proactively address regional environmental concerns with decision-making based on sound scientific principles

OUTCOME
Communities can address large-scale environmental concerns by integrating water ecosystem planning with land use planning.

WHO
Local governments, private sector, public sector, nonprofits, foundations

ACTION STEP
Refine strategies for funding long-term open space needs, including endowments and special community improvement projects

OUTCOME
Communities that plan long term will be incorporating green infrastructure right alongside streets and sewers to ensure quality of life over the long haul.

Goal #5
Improve communications among those with an interest in the long-term health of Wisconsin's Cities

WHO
Green infrastructure project leaders

ACTION STEP
Get training or solicit expertise in public relations and effective public participation techniques

OUTCOME
Communicating effectively with concerned citizens about open space issues, drawing them into the design and decision-making process, means a larger pool of resources to build the success of green infrastructure networks.

WHO
Private and public sector green infrastructure advocates

ACTION STEP
Establish cross-departmental communication, inclusive processes and nontraditional partnerships

OUTCOME
Increasing collaboration among partners in the environmental, social service, and business communities will strengthen ties and highlight common causes regarding land use.

WHO
Donors, foundations, green infrastructure advocates

ACTION STEP
Inform donors and foundations of the costs and benefits of green infrastructure

OUTCOME
By highlighting the transformative power of green infrastructures within communities, advocates can gain financial support for establishing and maintaining open space systems.

WHO
Government agencies, nonprofits

ACTION STEP
Within the atmosphere of increasing privatization of public services, develop nontraditional partnerships that dovetail strengths and weaknesses of each partner

OUTCOME
Communities would broaden their base of support for these projects and increase capacity.

WHO
Community Open Space Partnership

ACTION STEP
Honor the best green infrastructure projects in Wisconsin annually

OUTCOME
Recognizing green infrastructure pioneers would support and promote similarly innovative thinking statewide.

If we take these actions…	By building upon …	Then these results can flourish …
If the Wisconsin State Legislature establishes an Urban Stewardship Program to share costs of land acquisition and green infrastructure improvements with local communities	• The state's history of financial support for urban parks • The environmental awareness of elected officials and government department staff	Then communities will be able to sufficiently fund open space acquisition and improvements to meet citizens' needs and community goals.
If local units of government help fund their green infrastructure projects through the use of TIF districts, special assessment districts, CDBG funds, local ballot referendums, and capital campaigns	• The culture of grassroots support that values outdoor activity and environmental health • Strong area advocacy groups and the base of highly involved citizens	Then municipalities will be able to fully utilize existing funding strategies. Park professionals, community organizers, and public officials will build creative partnerships and use collaborative processes to carry out innovative funding strategies.
If the Wisconsin State Legislature approves enabling legislation for the establishment of special open space districts	• Successful forest preserve district models in Illinois and beyond • Current trends to consolidate services and increase cooperation among communities	Then communities can address their open space needs in relation to *regional* environmental, social and economic goals.
If open space professionals pioneer and refine comprehensive green infrastructure planning, public participation, and implementation strategies	• GIS technology and the extensive planning data available • The many people who care about the health of our cities • Residents' strong sense of place and community	Then techniques for planning and implementing green infrastructure projects will be fully developed, tested, and open spaces will reflect community values, respond to citizen needs, and address broader community goals.
If university professors join with green infrastructure leaders to thoroughly research the costs and benefits of establishing green infrastructure networks	• The research talents of Wisconsin's institutions of higher education • Established outreach networks of UW Extension	Then community decision-makers will be armed with objective data for evaluating the environmental, social and economic impacts of green infrastructure in Wisconsin.
If local nonprofits and Community Open Space Partnership members join forces to educate local foundations and individual philanthropists	• The strong level of community involvement in local issues • The expertise and influence of local community foundations	Then local foundations and philanthropists will grasp the potential for community transformation through open space and provide necessary "seed" money for green infrastructure initiatives.
If local government agencies identify and mobilize their green infrastructure constituency, and citizens organize "Friends-of" groups	• The active and committed citizenry embedded in neighborhoods and downtowns	Then 1) municipalities will be able to stabilize political decision-making regarding public funding, 2) citizens will help increase local capacity to manage existing public lands with project advocacy, education, private-sector fundraising, and volunteer management support, and 3) communities will not be afraid to increase the amount of their open space.

If we take these actions…	By building upon …	Then these results can flourish…
If the Governor of Wisconsin establishes a Task Force on Green Infrastructure	• The tradition of using such task forces to understand complex policy issues	Then we will be able to establish political consensus on a comprehensive vision for Wisconsin's cities and bring coherence to multiple support programs.
If local nonprofits and members of the Community Open Space Partnership join forces to educate local decision-makers on the potential of green infrastructure	• Opportunities provided by open minded elected officials • The environmental awareness of government department staff	Then decision-makers will come to know green infrastructure as an essential environmental, social, and economic element for sustaining the property tax base and citizens' quality of life.
If schools and churches sponsor forums for community discussion on the role of nature in cities, and nonprofit agencies expand their efforts to provide opportunities for hands-on experiences of the natural world	• The land ethic of citizens • The professional curiosity of local news media • The expertise of environmental organizations	Then Wisconsin's citizens will regain their sense of sacred connection and interdependency with nature, while participatory open space planning will reflect community values.
If local governments join with non-profit and for-profit leaders and citizens in addressing issues of environmental justice	• The local knowledge and commitment of area businesses, churches, and social service agencies	Then we will achieve a renewed commitment to environmental health for marginalized communities of color, while all community residents and visitors will feel welcome to access a variety of open spaces.
If local governments re-examine and align local zoning ordinances, subdivision ordinances, building codes, landscape regulations, architectural control regulations, sign ordinances, and storm water management ordinances so as to implement green infrastructure principles	• The professional skills of city staff • The political outreach and community education skills of local advocacy groups	Then local governments can harness available land use tools for achieving broad community-wide green infrastructure goals.
If local police forces become active partners in the design and maintenance of green infrastructure, and citizens formulate neighborhood watch programs for open space	• The community connections and existing expertise of Wisconsin's police departments	Then residents will again perceive open spaces as safe havens for everyone—not centers of criminal activity.

If we take these actions …	By building upon …	Then these results can flourish…
If real estate developers and nonprofit agencies present communities with alternative models of development or redevelopment, and Universities assist communities with cost-benefit analysis of these proposals	• Innovative and nationally tested development strategies • The research expertise housed in state and private institutions	Then communities will improve their local economies by leveraging the "proximity effect" of rising property values on lands surrounding green infrastructure, and maximize their return to the tax base and quality of life.
If nonprofits, landscape architects, and planning consultants join with the Community Open Space Partnership in advising communities on how they might best achieve integrated comprehensive systems	• The diversity of perspectives within the community • Planning techniques developed at the Community Open Space Partnership's 2002 Green Infrastructure Forums	Communities will design and build a network of spaces that enhance other public places and civic amenities, while enhancing ecological diversity and functions.
If planners—as a strategy for tying together all of the "elements" required in Wisconsin's comprehensive Smart Growth planning—integrate green infrastructure planning into all of the required elements (i.e. economic, transportation, etc.)	• Growing citizen awareness of the importance of land use planning	Then communities across the state will identify cost-effective natural solutions to planning challenges, and design sustainable futures where economic, transportation, agricultural and other systems function successfully when designed with nature instead of "in spite of" nature.
If the Department of Transportation reforms its policies to implement local land use and green infrastructure plans, and to protect and enhance wildlife migration corridors	• The open mindedness and expertise of government staff	Then the Department of Transportation will positively affect the physical, emotional, cognitive, and spiritual growth of citizens and become a partner in honoring local and regional land use plans as transportation needs are met.
If state agencies review and amend their grant making and permitting rules to favor cost-effective, sustainable green infrastructure solutions that serve multiple community goals	• Trends to leverage limited state monies with innovative private sector initiatives	Then Wisconsin will begin to shed its dependence on engineered solutions to natural resource management in cities.
If the non-profit and for-profit sectors join with the Department of Natural Resources to identify areas of rule incompatibility and make policy improvements	• The diverse expertise available to state agencies from various established rule-making committees	Then policy incompatibilities between DNR programs—like storm water and brownfield programs—will be identified and resolved.

If we take these actions …	By building upon …	Then these results can flourish…
If green infrastructure pioneers partner with other open space planners/designers to develop strategies that promote economic development opportunities, celebrate local history, provide cultural sensitivity, and foster sustainable environmental decision-making	• A wealth of existing professional relationships • Wisconsin's history of conservation leadership	Then open space planners and designers will go beyond traditional practices of providing per-capita formula-based recreational services and create places that spur economic investments, promote cultural understanding, interpret environmental and cultural identities, and foster community pride.
If municipalities embrace inclusive public decision-making processes that result in vision and goals for a comprehensive system that is community—not developer—driven	• A culture of grassroots support that is aware of its environmental ethic and values sustainable quality of life • Residents' strong sense of place and community	Then the creation of new public open spaces will cease to be merely opportunistic and haphazard. Creative partnerships and collaborative implementation processes for acquiring, funding and managing open space will emerge.
If local open space planners seek information on regional environmental concerns and secure assistance in scientifically-based decision-making	• The ever-growing body of data and technical analysis created to aid natural resource management	Then green infrastructure systems will respond to large-scale environmental concerns. The sitting and design of open space can consistently incorporate sound scientific principles regarding ecosystems and the connection between land and water resources.
If local governments set aside dedicated funds to prepare for changing needs over time, and the public and private sectors join forces to fundraise for green infrastructure endowments or special community improvement projects	• Environmental awareness of government leaders • Strong nonprofit interests and fundraising expertise • Existing spirit of cooperation	Then open spaces will have their required investments, just as highways and sewers do. The quality of the environment and visitor enjoyment will be secure over time.

Green Infrastructure for Tomorrow
A Call to Action: Improve Communication

If we take these actions …	By building upon …	Then these results can flourish…
If green infrastructure project leaders get training and seek assistance in public relations and/or effective public participation techniques	• The professional expertise within the community • The knowledge and skills of UW Extension and other technical assistance agencies	Then citizens will be informed about and meaningfully engaged in open space design and decision-making. Citizens of various talents and interests will devote time and resources to the success of green infrastructure networks.
If green infrastructure project leaders establish cross-departmental communication, inclusive processes, and non-traditional partnerships	• Models of cooperation • Increasing trends toward collaboration	Then traditional and non-traditional partnerships will be strengthened, and the environmental, business, and social service communities will realize their interdependency in matters regarding land use.
If advocates for green infrastructure inform donors or potential donors of the costs and benefits of open space systems	• Existing relationships to the philanthropic community • The public relations interests of corporations	Then the philanthropic community will learn of the power of green infrastructure to meaningfully transform neighborhoods and downtowns, and they will come to understand the financial requirements for establishing and maintaining open space systems.
If government agencies seek nonprofit partners to better manage project risks by matching one agency's weaknesses with another agency's strengths (and vice versa)	• Increasing trends toward privatization of public services	Then the base of green infrastructure project support will broaden as program capacity increases.
If the Community Open Space Partnership continues its annual Green Ribbon Awards to honor the best green infrastructure projects in Wisconsin, and if the Partnership initiates a "project endorsement" process	• Wisconsin's growing urban open space portfolio	Then agencies—and their leaders who are pioneering green infrastructure projects—will be appropriately recognized. Endorsement procedures will support and promote innovative thinking statewide.

Endnotes

Ecological Benefits

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Community Open Space Partnership
Member Organizations as of May 1, 2003

1000 Friends of Wisconsin
American Planning Association, Wisconsin Chapter
American Society of Landscape Architects, Wisconsin Chapter
America's Outdoors
Buettner & Associates, Inc.
Center for Land Use Education
Center for Urban Initiatives and Research, University of Wisconsin-Milwaukee
City of Milwaukee – Department of Public Works (Forestry)
City of Waukesha Parks, Recreation, and Forestry
City of West Bend
Cultural Waters, Inc.
Dane County Parks
Dane County Regional Planning Commission
East Central Wisconsin Regional Planning Commission
Fox Cities Greenways
Fox-Wolf Watershed Alliance
Friends of Milwaukee's Rivers
Green Bay Green Map
Heart Lake Conservation Associates, LLC
Land Trust Alliance
Milwaukee Community Service Corps
Milwaukee Metropolitan Sewerage District
Milwaukee Urban Gardens
Menomonee Valley Partners, Inc.
National Park Service Rivers & Trails Program
Northeast Wisconsin Land Trust
Oneida Nation
Partners in Place
River Revitalization Foundation
Rock River Coalition
Smart Growth Partners
Town of Greenville
Trust for Public Land
Urban Open Space Foundation
UW Cooperative Education Basin Education
UW-Madison Department of Landscape Archtecture
UW-Madison Department of Urban & Regional Planning
UW-Milwaukee School of Architecture and Urban Planning
Wisconsin Alliance of Cities
Wisconsin DNR
Wisconsin Parks & Recreation Association
YMCA – CDC Riverwest, Milwaukee

In the fall of 2002 and spring of 2003, a group called the Community Open Space Partnership (COSP) brought more than 200 individuals together at a series of forums. Sharing ideas and suggestions, they started the work on a plan to encourage the state of Wisconsin and its communities to build and expand upon networks of open spaces in order to increase the beauty and vitality of our cities and towns. Their combined strategies were shaped into this report.

The Community Open Space Partnership brings this publication to you—a broad-based coalition of nearly 40 agencies in Wisconsin dedicated to promoting comprehensive networks of open spaces in and around cities.

Our work together is made possible through the generous support of the USDA Forest Service Urban and Community Forestry Program, and from the Urban Open Space Foundation. The Department of Natural Resources, American Society of Landscape Architects—Wisconsin Chapter, the Milwaukee Metropolitan Sewerage District, the UW Milwaukee School of Architecture and Urban Planning, and the Beldon Fund.

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